SOIL SURVEY OF

Nevada County Area, California

United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
University of California
Agricultural Experiment Station

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of the Nevada County Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the range site, woodland suitability group, and wildlife suitability group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay for the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the vegetative groups, the range sites, and the woodland suitability groups.

Foresters and others can refer to the section "Use of the Soils for Woodland," where the soils of the Area are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

Ranchers and others can find, under "Use of the Soils for Range," groupings of the soils according to their suitability for range, and also the name of many of the plants that grow on each range site.

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreational areas in the section "Use of the Soils for Community Development."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in the Nevada County Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the Area given at the beginning of the publication and in the section "General Nature of the Area."

Cover: Area of land in the Ahwahnee-Sierra association.

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SOIL SURVEY OF NEVADA COUNTY AREA, CALIFORNIA

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE AND FOREST SERVICE, IN COOPERATION WITH UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

THE NEVADA COUNTY AREA is east of the Great Valley of California (fig. 1.). The area consists of slightly less than the western half of Nevada County and is in the northeast central part of California. It is 341,966 acres in extent and most of the land is privately owned. The rest of Nevada County is largely in Tahoe National Forest. The Area generally ranges from 1 to 6 miles into the western boundary of Tahoe National Forest. Nevada City, the county seat of Nevada County, has a population of slightly more than 2,500. Grass Valley is the largest city in the county, and has a population of approximately 5,800.

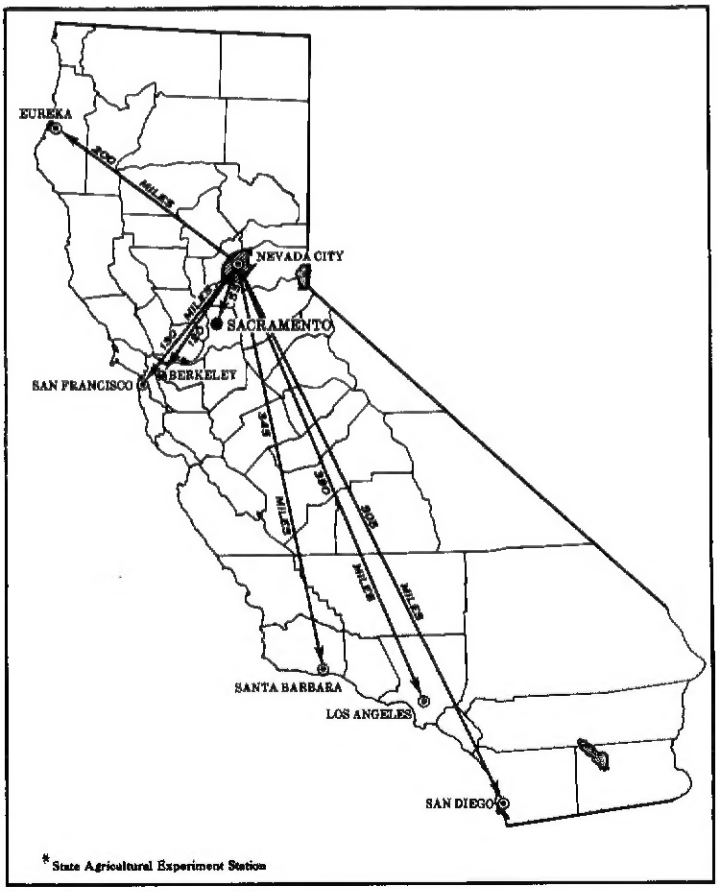

Figure 1.—Location of Nevada County Area in California.

Nevada County is one of the smaller mountain counties on the western slope of the Sierra Nevada mountain range in northeast-central Califorinia. It is long, narrow, and somewhat irregular in shape. To the west, the county begins near the floor of the Great Valley and extends over the crest of the Sierra to the Nevada State line, its eastern boundary. To the south, much of the boundary is formed by the Bear River, and to the north, by the Middle Yuba River. The county is about 70 miles long. Elevation ranges from 400 feet in the low foothills to about 9,000 feet in the mountainous peaks along the crest of the Sierras. In the 1840's gold was discovered in Nevada County and in adjoining counties and extensive exploration and development resulted.

Today the lower foothills of the Area are mostly in grass and used as range for beef cattle. The higher elevations consist mostly of forests of conifer and hardwood. Ponderosa pine is the dominant species cut for lumber. A fairly large acreage is in brush and less than 1 percent of the soils in the survey area are used for crops or deciduous orchards. Irrigation water is distributed to much of the county where most of this water is used to irrigate the pastures.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Nevada County Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and

the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for differences in the texture of the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Ahwahnee and Aiken, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Ahwahnee sandy loam, 2 to 9 percent slopes, is one of several phases within the Ahwahnee series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this survey was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. The only such kind of mapping unit shown on the soil map of the Nevada County Area is the soil complex.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Auburn-Argonaut complex, 2 to 15 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Alluvial land, loamy, is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundation for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for the onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to a high water table. They see that streets, road pavements, and foundations of houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in the Nevada County Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in the Area, who want to compare different parts of the Area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The 9 soil associations in the Nevada County Area are discussed in the following pages. They are grouped into the two main physiographic sections of the Area: the mountainous uplands and the middle and lower foothills. The soil associations have been grouped principally on the basis of soil differences that are related to differences in parent rock. The terms for texture used in the title of the associations apply to the tex-

ture of the surface layer. For example, in the title of association 1, the words "sandy loams" refer to the texture of the surface layer.

Soils of the Lower and Middle Foothills

The lower and middle foothills consist of gently sloping to steep soils on hills that have a few conspicuous peaks. Elevation ranges from 300 to 2,000 feet. Annual precipitation ranges from 26 to 45 inches. Rock outcrops are common. The soils are generally shallow or moderately deep. The lower and middle foothills make up about 28 percent of the area. Three soil associations are in this group. The soils in these associations formed in material weathered from metabasic rock, granitic rock, and basic igneous rock. The plant cover in all three associations is grass and oak, but some areas are in brush and coniferous trees.

1. *Ahwahnee-Sierra association*

Gently rolling to steep, well-drained sandy loams formed over granitic rock

This association consists of gently rolling to steep soils on foothills in the west-central and northeastern parts of the survey area. These soils are underlain by weathered granitic rock. Slopes are 2 to 50 percent. The vegetation is oak and grass. Elevation ranges from 400 to 2,000 feet, and annual precipitation ranges from 28 to 45 inches. The average annual temperature is about 60° F. The frost-free season is 235 to 260 days.

This association makes up 7 percent of the survey area. About 65 percent of the association is Ahwahnee soils, about 25 percent is Sierra soils, and the other 10 percent is Granitic rock land and Auberry soils.

Ahwahnee soils have a surface layer of dark grayish-brown and brown sandy loam and a subsoil of brown, yellowish-brown, and reddish-yellow heavy sandy loam. Depth to weathered granitic rock is 30 to 40 inches.

Sierra soils have a surface layer of brown and dark-brown sandy loam and a subsoil of reddish-brown heavy sandy loam and yellowish-red and reddish-yellow sandy clay loam. Depth to weathered granitic rock is 42 to 60 inches or more.

The soils of this association are used for annual range, dry pasture and irrigated pasture, and hay. Parcelling of the land in this association into small units has occurred in the vicinity of Penn Valley.

2. *Auburn-Sobrante association*

Undulating to steep, well-drained loams formed over metabasic rock.

This association consists of undulating to steep soils on foothills in the western and southwestern parts of the survey area. These soils are underlain by weathered metabasic rock. Slopes are 2 to 50 percent. The vegetation is oak and grass. Elevation ranges from 300 to 2,000 feet, and annual precipitation ranges from 26 to 45 inches. The average annual temperature is about 60° F. The frost-free season is 235 to 265 days.

This association makes up about 15 percent of the survey area. About 60 percent of the association is Auburn soils and about 30 percent is Sobrante soils. The other 10 percent is Argonaut soils and rock outcroppings.

Auburn soils have a surface layer of brown and reddish-brown loam and a subsoil of yellowish-red light clay loam. Depth to weathered metabasic rock is 14 to 27 inches.

Sobrante soils have a surface layer of reddish-brown loam and a subsoil of reddish-brown heavy loam and light clay loam. Depth to weathered metabasic rock ranges from 24 to 36 inches.

The soils of this association are used for annual range, dry pasture, and irrigated pasture. Urban expansion has occurred within this association.

3. *Trabuco-Sierra association*

Gently rolling to steep, well-drained loams and sandy loams formed over granitic rock

This association consists of gently rolling to steep soils on foothills west of Grass Valley and north of Highway 20, east of Pleasant Valley Road and south of the South Fork of the Yuba River. These soils are underlain by weathered granitic rock. Slopes are 2 to 50 percent. The vegetation is oak and grass. Elevation ranges from 400 to 2,000 feet, and annual precipitation ranges from 28 to 40 inches. The average annual temperature is 60° to 61° F. The frost-free season is 235 to 260 days.

This association makes up 6 percent of the survey area. About 50 percent of the association is Trabuco soils, and about 45 percent is Sierra soils. The other 5 percent is Auberry soils and rock outcroppings.

Trabuco soils have a surface layer of reddish-brown loam and a subsoil of reddish-brown clay loam, dark-red clay, and yellowish-red clay loam. Depth to weathered granitic rock is 42 to 60 inches or more.

Sierra soils have a surface layer of brown and dark-brown sandy loam and a subsoil of reddish-brown heavy sandy loam and yellowish-red and reddish-yellow sandy clay loam. Depth to weathered granitic rock ranges from 42 to 60 inches or more.

The soils of this association are used for annual range, dry pasture and irrigated pasture, and hay. Urban expansion has occurred within this association.

Soils of the Mountainous Uplands

The mountainous uplands consist of undulating to very steep soils dissected by generally southwest-flowing river channels. Elevation ranges from 500 to 4,500 feet. Annual precipitaion ranges from 28 to 60 inches. Rock outcrops, cobblestones, and stones are common. The soils are generally moderately deep to very deep, but in some areas they are shallow. The mountainous uplands make up about 72 percent of the area. Six soil associations are in this group. The soils of these associations formed in material weathered from metabasic, metasedimentary, granitic, and ultrabasic rock and andesitic conglomerate. The plant cover is generally mixed conifer and hardwood forest, but some areas are in brush and oak and grass.

4. *Aiken-Cohasset association*

Gently sloping to steep, well-drained loams and cobbly loams formed over andesitic conglomerate and metabasic rock

This association consists of gently sloping to steep soils on mountainous uplands (fig. 2) in the eastern and northeastern parts of the survey area. These soils are underlain by deeply weathered or tuff-cemented andesitic conglomerate. Slopes are 2 to 50 percent. The vegetation is conifer-hardwood forest. Elevation ranges from 2,000 to 4,000 feet and annual precipitation ranges from 48 to 58 inches. The average annual temperature is about 56° F. The frost-free season is 140 to 230 days.

This association makes up 15 percent of the survey area. About 55 percent of the association is Aiken soils, about 35 percent is Cohasset soils, and the other 10 percent is Iron Mountain, McCarthy, and Sites soils.

Aiken soils have a surface layer of brown, dark-brown, and yellowish-red loam and a subsoil of yellowish-red and reddish-yellow heavy clay loam and heavy loam. Depth to weathered andesitic conglomerate is 48 to 60 inches or more.

Cohasset soils have a surface layer of brown loam and a subsoil of reddish-brown and strong-brown heavy loam and clay loam. Depth to weathered andesitic conglomerate is 42 to 60 inches or more. In places Aiken and Cohasset soils are cobbly throughout the profile.

The soils of this association are used mostly for timber production, but some of the more gently sloping soils are used for deciduous orchards and limited grazing. Urban expansion has occurred in the vicinity of Banner Mountain and along Ridge Road.

5. *Boomer-Sites-Sobrante association*

Undulating to steep, well-drained loams formed over metabasic rock

This association consists of undulating to steep soils on mountainous uplands in the south-central and north-central parts of the survey area west of Highway 49. These soils are underlain by metabasic or metasedimentary rock. Slopes are 2 to 50 percent. Rock outcrops are present in many areas. The vegetation is dominantly conifer-hardwood forest. Elevation ranges from 500 to 4,000 feet, and annual precipitation ranges from 28 to 60 inches. The average annual temperature is 55° to 60° F. The frost-free season is about 140 to 260 days.

This association makes up 11 percent of the survey area. About 55 percent of the association is Boomer soils, about 25 percent is Sites soils, and about 10 percent is Sobrante soils. The other 10 percent is Josephine and Rescue soils.

Boomer soils have a surface layer of brown to reddish-brown loam and a subsoil of reddish-brown and yellowish-red heavy loam and clay loam. Depth to weathered metabasic rock is 40 to 60 inches or more.

Figure 2.—View northwest from Banner Mountain Lookout: Aiken and Cohasset soils on Harmony Ridge; Sites very stony loam, 15 to 50 percent slopes, in the foreground.

Sites soils have a surface layer of brown and yellowish-red heavy loam and a subsoil of yellowish-red clay loam and red clay. Depth to weathered metabasic or metasedimentary rock is 40 to 60 inches or more.

Sobrante soils have a surface layer of reddish-brown loam and a subsoil of reddish-brown heavy loam and clay loam. Depth to weathered metabasic rock is 24 to 36 inches.

The soils of this association are used mostly for annual range and irrigated pasture and improved dry pasture. Some of the more gently sloping areas are used for timber production and deciduous orchards. Urban expansion has occurred near the intersection of Combie and Magnolia Roads.

6. *Hoda-Chaix-Musick association*

Gently sloping to very steep, well-drained sandy loams formed over metasedimentary and metabasic rock

This association consists of gently sloping to very steep soils on mountainous uplands in the central and north-central parts of the survey area. These soils are underlain by deeply weathered granitic rock. Slopes are 5 to 75 percent. Rock outcrops are common in places. The vegetation is dominantly conifer hardwood forest. Elevation ranges from 1,200 to 4,000 feet, and annual precipitation ranges from 35 to 55 inches. The average annual temperature is 52° to 58° F. The frost-free season is 145 to 250 days.

This association makes up 12 percent of the survey area. About 30 percent of the association is Hoda soils, about 30 percent is Chaix soils, and about 25 percent is Musick soils. The other 15 percent is Hotaw and Josephine soils.

Hoda soils have a surface layer of brown sandy loam and a subsoil of reddish-yellow loam and yellowish-red clay and sandy clay loam. Depth to weathered granodiorite is 60 inches or more.

Chaix soils have a surface layer of light-gray and very pale brown sandy loam and a subsoil of very pale brown heavy sandy loam. Depth to weathered granodiorite is 20 to 40 inches.

Musick soils have a surface layer of brown and reddish-brown sandy loam and loam and a subsoil of yellowish-red and red heavy clay loam. Depth to weathered granodiorite is 40 to 60 inches or more.

The soils of this association are used for grazing, irrigated pasture and dry improved pasture, and timber production. Urban expansion has occurred east of Nevada City along Willow Valley and Murchie Roads.

7. *Josephine-Sites-Mariposa association*

Undulating to very steep, well-drained loams formed over metasedimentary and metabasic rock

This association consists of undulating to very steep soils on mountainous uplands in the southeastern and northeastern parts of the survey area. These soils are underlain by metasedimentary rock or metabasic rock. Slopes are 2 to 75 percent. The vegetation is mostly conifer-hardwood forest. Elevation ranges from 2,000 to 4,500 feet, and annual precipitation ranges from 40 to 60 inches. The average annual temperature is 55° or 56° F. The frost-free season is 135 to 240 days.

This association makes up about 22 percent of the survey area. About 35 percent of the association is Josephine soils, about 35 percent is Sites soils, and about 20 percent is Mariposa soils. The other 10 percent is Maymen, Cohasset, and McCarthy soils.

Josephine soils have a surface layer of reddish-brown loam or cobbly loam and a subsoil of reddish-yellow silty clay loam or cobbly clay loam. Depth to weathered metasedimentary rock is 40 to 60 inches or more.

Sites soils have a surface layer of brown and yellowish-red loam or very stony loam and a subsoil of yellowish-red clay loam and red clay. Depth to weathered metasedimentary and metabasic rock is 40 to 60 inches or more. Rock outcrops are common in some areas of these soils.

Mariposa soils have a surface layer of brown gravelly loam and a subsoil of yellowish-brown gravelly loam and reddish-yellow gravelly clay loam. Depth to weathered metasedimentary rock is 15 to 31 inches. Rock outcrops are common in some areas of these soils.

The soils of this association are used for timber production, grazing, irrigated pasture and improved dry pasture, and deciduous orchards. Some urban expansion has occurred along Colfax Highway between Grass Valley and the Bear River.

8. *Secca-Boomer association*

Undulating to steep, well drained and moderately well drained gravelly silt loams and loams formed over metabasic rock.

This association consists of undulating to steep soils on mountainous uplands in the west-central part of the survey area. These soils are underlain by weathered metabasic rock. Slopes are 2 to 50 percent. Rock outcrops are common in many areas. The vegetation is oak and grass and some brush and conifer. Elevation ranges from 1,000 to 3,000 feet and annual precipitation ranges from 30 to 55 inches. The average annual temperature is 56° to 58° F. The frost-free season is 200 to 260 days.

This association makes up 6 percent of the survey area. About 70 percent of the association is Secca soils, and about 20 percent is Boomer soils. The other 10 percent is Dubakella soils near Grass Valley and Nevada City.

Secca soils are moderately well drained and have a surface layer of brown and reddish-brown gravelly silt loam and a subsoil of yellowish-red, strong-brown, and light yellowish-brown cobbly silty clay loam and cobbly clay. Depth to weathered metabasic rock is 40 to 60 inches or more.

Boomer soils are well drained and have a surface layer of brown to reddish-brown loam and a subsoil of reddish-brown and yellowish-red and reddish-yellow heavy loam and clay loam. Depth to weathered metabasic rock is 40 to 60 inches or more.

The soils of this association are used mostly for annual range, improved dry pasture and irrigated pasture, and watershed. They are also used for limited timber production.

9. *Placer diggings-Tailings-Horseshoe association*

Placer mining debris, riverwash, waste rock, and rolling to hilly, well-drained loams formed over gravelly terrace remnants

This association consists of gently rolling to extremely steep areas of sandy, cobbly riverwash; sandy, gravelly, and cobbly piles of hydraulic and placer mining debris; and areas of soils formed in tertiary river gravel. These soil materials are on mountainous uplands generally in the southeastern, northeastern, and east-central parts of the survey area. Slopes are 2 to 75 percent. The riverwash and mining debris are very shallow to very deep. The soils are underlain by stratified tertiary river deposits. The vegetation is dominantly conifer-hardwood forest. Elevation ranges from 800 to 4,500 feet and annual precipitation ranges from 30 to 60 inches. The average annual temperature is about 55° F. but varies, depending upon elevation. The frost-free season is 140 to 260 days.

This association makes up about 6 percent of the survey area. About 35 percent of the association is Placer diggings, about 25 percent is Tailings, and about 25 percent is Horseshoe soils. The other 15 percent is small tracts of various soils in places that have been used for placer mining operations.

Placer diggings are areas along natural drainageways that have been placer mined or areas along those drainageways where natural deposition and sorting of gravelly, cobbly, or stony material has taken place.

Tailings are areas that have been hydraulically mined, are essentially without fine material, and contain 90 to 100 percent stones, cobblestones, and gravel. The stones and cobblestones are often piled in windrows.

Horseshoe soils have a surface layer of reddish-brown and yellowish-red gravelly loam and a subsoil of yellowish-red and red gravelly clay loam underlain by strong-brown very gravelly loam. Depth to stratified tertiary sand and gravel is 48 to 72 inches.

Horseshoe soils and Placer diggings in this association are used for timber production and limited grazing. Tailings are unsuitable for most agricultural uses. They are used for watershed and recreation, and as wildlife habitat.

Descriptions of the Soils

This section describes the soil series and mapping units in the Nevada County Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless specifically mentioned otherwise, it is to be assumed that what is stated about the soil series is true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit differs from the one described for the series, the differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated. Percentages of coarse fragments are by volume.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Rock land and Tailings, for example, do not belong to a soil series, but nevertheless, are listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit in which the mapping unit has been placed. The page for the description of each capability unit, range site, woodland suitability group, and wildlife suitability group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The approximate acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*13*).[1]

Ahwahnee Series

The Ahwahnee series consists of well-drained soils underlain by weathered granodiorite. These soils are undulating to steep and are on mountainous uplands. Slopes are 2 to 50 percent. The vegetation is mostly annual grasses and forbs, oak, and scattered areas of digger and ponderosa pine. Elevation ranges from 400 to 1,600 feet. The annual rainfall is 28 to 45 inches, and the average annual air temperature is about 60° F. The frost-free season is 235 to 260 days.

In a representative profile the surface layer is about 8 inches of dark grayish-brown and brown sandy loam. Reaction is slightly acid and medium acid. The subsoil is about 30 inches of brown, yellowish-brown, and reddish-yellow sandy loam and heavy sandy loam. Reaction in the subsoil is medium acid. A substratum of weathered granodiorite is at a depth of about 38 inches.

Permeability is moderately rapid in these soils. Effective rooting depth is 30 to 40 inches. Available water holding capacity is 4 to 6 inches.

The Ahwahnee soils are used for annual range, improved dry pasture, and irrigated pasture.

Representative profile of Ahwahnee sandy loam, 2 to 9 percent slopes, 9½ miles south-southwest of Grass Valley, on the west side of McCourtney Road, 900 feet east and 1,000 feet south of the northwest corner of sec. 1, T. 14 N., R. 7 E.:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) when

[1] Italic numbers in parentheses refer to Literature Cited, p. 103.

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Ahwahnee sandy loam, 2 to 9 percent slopes	1,647	0.5
Ahwahnee sandy loam, 9 to 15 percent slopes	3,971	1.2
Ahwahnee sandy loam, 15 to 30 percent slopes	568	.2
Ahwahnee-Rock outcrop complex, 15 to 30 percent slopes	4,465	1.3
Ahwahnee-Rock outcrop complex, 30 to 50 percent slopes	1,615	.5
Aiken loam, 2 to 9 percent slopes	4,623	1.4
Aiken loam, 9 to 15 percent slopes	5,114	1.5
Aiken loam, 15 to 30 percent slopes	4,417	1.3
Aiken loam, 30 to 50 percent slopes	1,968	.6
Aiken cobbly loam, 2 to 30 percent slopes	2,265	.7
Aiken cobbly loam, 30 to 50 percent slopes	918	.3
Alluvial land, clayey	2,790	.8
Alluvial land, loamy	2,158	.6
Argonaut gravelly loam, 2 to 15 percent slopes	825	.2
Argonaut-Rock outcrop complex, 2 to 30 percent slopes	1,066	.3
Auberry sandy loam, 5 to 15 percent slopes	1,901	.6
Auberry-Rock outcrop complex, 15 to 30 percent slopes	941	.3
Auberry-Rock outcrop complex, 30 to 50 percent slopes	610	.2
Auburn loam, 2 to 30 percent slopes	5,287	1.5
Auburn-Argonaut complex, 2 to 15 percent slopes	1,399	.4
Auburn-Rock outcrop complex, 2 to 30 percent slopes	14,899	4.3
Auburn-Rock outcrop complex, 30 to 50 percent slopes	7,895	2.2
Boomer loam, 5 to 15 percent slopes	4,810	1.3
Boomer loam, 15 to 30 percent slopes	2,932	.9
Boomer-Rock outcrop complex, 5 to 30 percent slopes	18,561	5.3
Boomer-Rock outcrop complex, 30 to 50 percent slopes	15,494	4.4
Chaix sandy loam, 15 to 50 percent slopes, eroded	1,355	.4
Chaix-Hotaw complex, 5 to 15 percent slopes, eroded	1,086	.3
Chaix-Hotaw complex, 15 to 30 percent slopes, eroded	2,841	.8
Chaix-Hotaw complex, 30 to 50 percent slopes, eroded	2,848	.8
Chaix-Rock outcrop complex, 30 to 75 percent slopes	3,529	1.0
Chaix very stony loam, thick solum variant, 5 to 15 percent slopes	682	.2
Chaix very stony loam, thick solum variant, 15 to 30 percent slopes	683	.2
Chaix very stony loam, thick solum variant, 30 to 50 percent slopes	775	.2
Cohasset loam, 2 to 9 percent slopes	3,590	1.0
Cohasset loam, 9 to 15 percent slopes	1,086	.3
Cohasset loam, 15 to 30 percent slopes	1,844	.5
Cohasset cobbly loam, 5 to 30 percent slopes	7,821	2.3
Cohasset cobbly loam, 30 to 50 percent slopes	4,856	1.4
Cohasset-McCarthy cobbly loams, 15 to 50 per cent slopes	1,483	.4
Cohasset-McCarthy cobbly loams, 50 to 75 percent slopes	1,036	.3
Cut and fill land	346	.1
Dubakella, shallow variant-Rock outcrop complex, 2 to 50 percent slopes	1,374	.4
Granitic rock land	1,824	.5
Hoda sandy loam, 5 to 9 percent slopes	3,395	1.0
Hoda sandy loam, 9 to 15 percent slopes	593	.2
Hoda sandy loam, 15 to 50 percent slopes	7,509	2.2
Hoda cobbly sandy loam, 2 to 15 percent slopes, eroded	730	.2
Hoda-Rock outcrop complex, 50 to 75 percent slopes	886	.3
Horseshoe gravelly loam, 9 to 15 percent slopes	1,612	.5
Horseshoe gravelly loam, 15 to 30 percent slopes	2,686	.8
Iron Mountain cobbly loam, 2 to 50 percent slopes	3,088	.9
Josephine loam, 9 to 15 percent slopes	1,918	.6
Josephine loam, 15 to 30 percent slopes	3,289	1.0
Josephine loam, 30 to 50 percent slopes	1,803	.5
Josephine cobbly loam, 5 to 30 percent slopes	820	.2
Josephine-Mariposa complex, 15 to 50 percent slopes, eroded	17,356	4.9
Josephine-Mariposa complex, 50 to 75 percent slopes, eroded	5,973	1.7
Josephine-Rock outcrop complex, 15 to 50 percent slopes	3,110	.9
Marisposa gravelly loam, 2 to 30 percent slopes	1,584	.5
Mariposa-Maymen complex, 50 to 75 percent slopes, eroded	3,935	1.2
Mariposa-Rock outcrop complex, 2 to 50 percent slopes	1,365	.4
Maymen-Mariposa complex, 2 to 50 percent slopes, eroded	2,180	.6
McCarthy sandy loam, 15 to 50 percent slopes	635	.2
McCarthy cobbly loam, 5 to 15 percent slopes	1,674	.5
McCarthy cobbly loam, 15 to 50 percent slopes	3,163	.9
Musick sandy loam, 5 to 15 percent slopes	2,495	.7
Musick sandy loam, 15 to 50 percent slopes	7,700	2.2
Musick-Rock outcrop complex, 5 to 50 percent slopes	1,877	.5
Placer diggings	6,454	1.9
Rescue-Rock outcrop complex, 5 to 30 percent slopes	4,198	1.2
Rock land	4,823	1.4
Rock outcrop-Ahwahnee complex, 9 to 50 percent slopes	3,714	1.1
Rock outcrop-Auburn complex, 2 to 30 percent slopes	3,139	.9
Rock outcrop-Dubakella complex, 5 to 50 percent slopes	1,992	.6
Secca-Rock outcrop complex, 2 to 50 percent slopes	14,061	4.1
Shenandoah sandy loam, 2 to 15 percent slopes	1,007	.3
Sierra sandy loam, 2 to 9 percent slopes	2,048	.6
Sierra sandy loam, 9 to 15 percent slopes	2,498	1.0
Sierra sandy loam, 15 to 30 percent slopes	917	.3
Sierra-Rock outcrop complex, 15 to 30 percent slopes	2,256	.7
Sierra-Rock outcrop complex, 30 to 50 percent slopes	3,676	1.1
Sites loam, 2 to 9 percent slopes	2,471	.7
Sites loam, 9 to 15 percent slopes	3,866	1.1
Sites loam, 15 to 30 percent slopes	6,124	1.8
Sites very stony loam, 2 to 15 percent slopes	3,272	1.0
Sites very stony loam, 15 to 50 percent slopes	10,796	3.2
Sobrante loam, 2 to 15 percent slopes	3,625	1.1
Sobrante loam, 15 to 30 percent slopes	1,752	.5
Sobrante-Rock outcrop complex, 2 to 30 percent slopes	9,162	2.7
Sobrante-Rock outcrop complex, 30 to 50 percent slopes	4,385	1.3
Tailings	4,448	1.3
Trabuco loam, 5 to 15 percent slopes	3,249	1.0
Trabuco-Rock outcrop complex, 15 to 30 percent slopes	2,072	.6
Trabuco-Rock outcrop complex, 30 to 50 percent slopes	1,443	.4
Water	1,999	.6
Total	341,966	100.0

moist; moderate, medium and coarse, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; slightly acid; abrupt, smooth boundary.

A12—2 to 8 inches, brown (10YR 5/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine and few fine interstitial pores; medium acid; clear, wavy boundary.

B1—8 to 16 inches, brown (10YR 5/3) sandy loam, dark brown (7.5YR 3/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine and many medium and coarse roots; many very fine interstitial and few fine tubular and interstitial pores; medium acid; clear, wavy boundary.

B2t—16 to 33 inches, yellowish-brown (10YR 5/4) heavy sandy loam, dark brown (7.5YR 4/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; very few fine and many medium and coarse roots; common very fine and fine tubular and interstitial pores; few thin clay films as colloid stains and as bridges between mineral grains; medium acid; clear, wavy boundary.

B3t—33 to 38 inches, reddish-yellow (7.5YR 6/6) heavy sandy loam, yellowish red (5YR 4/8) when moist; massive; hard, firm, slightly sticky and slightly plastic; few medium and coarse roots; few very fine interstitial pores; common moderately thick clay films on mineral grains and as bridges between mineral grains; medium acid; clear, wavy boundary.

C—38 inches, weathered granodiorite.

The A horizon ranges from dark grayish brown or brown to pale brown in the lower part. It is medium acid or slightly acid. The B2t horizon ranges from yellowish brown to light brown. It is medium acid or strongly acid. The B3t horizon ranges from reddish-yellow to pink heavy sandy loam or heavy coarse sandy loam. The C horizon is weathered granodiorite. Reaction decreases with depth in Ahwahnee soils. Coarse gravel or cobblestones are present in places. Depth to weathered granodiorite ranges from 30 to 40 inches.

Ahwahnee sandy loam, 2 to 9 percent slopes (AdB).—This gently undulating and rolling soil is on mountainous uplands. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Auberry sandy loam and Sierra sandy loam. Also included are areas of Ahwahnee soils as much as 48 inches deep and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Ahwahnee soil is used for annual range, improved dry pasture, and irrigated pasture. It is susceptible to erosion under clean cultivation. Capability unit IIIe–1 (18).

Ahwahnee sandy loam, 9 to 15 percent slopes (AdC).—This soil is rolling. In most places rock outcrops cover 2 to 10 percent of the surface area.

Included with this soil in mapping are small areas of Auberry sandy loam and Sierra sandy loam. Also included are small areas of Ahwahnee soils that have slopes of 2 to 9 percent.

Runoff is medium on this soil. The hazard of erosion is moderate to high.

This Ahwahnee soil is used for annual range and, to some extent, for improved dry pasture and irrigated pasture. Capability unit IVe–1 (18).

Ahwahnee sandy loam, 15 to 30 percent slopes (AdD).—This hilly soil is on uplands. A few rock outcrops are present in places.

Included with this soil in mapping are small areas of Auberry sandy loam and Sierra sandy loam.

Runoff is medium to rapid on this soil. The hazard of erosion is high.

This Ahwahnee soil is used for annual range. Capability unit VIe–1 (18).

Ahwahnee-Rock outcrop complex, 15 to 30 percent slopes (AeD).—The soil material of this complex is hilly and is on mountainous uplands. Rock outcrops cover 10 to 25 percent of the surface area, in exposures that are about 30 to 100 feet apart.

Included in mapping are areas of Auberry sandy loam and Sierra sandy loam.

Runoff is medium to rapid on the soils of this complex. The hazard of erosion is high.

This complex is used for annual range. Capability unit VIs–1 (18).

Ahwahnee-Rock outcrop complex, 30 to 50 percent slopes (AeE).—The soil material of this complex is steep and is on mountainous uplands. Rock outcrops cover 10 to 25 percent of the surface area, in exposures that are about 30 to 100 feet apart.

Included in mapping are areas of Auberry sandy loam and Sierra sandy loam.

Runoff is rapid on the soils of this complex. The hazard of erosion is very high.

This complex is used for annual range. Permanent cover should be maintained at all times. Capability unit VIIs–1 (18).

Aiken Series

The Aiken series consists of well-drained soils underlain by cobbly andesitic tuff and conglomerate. These soils are on tabular volcanic ridges and colluvial side slopes. The soils on ridges are undulating to steep, and those on side slopes are strongly sloping to steep (fig. 3). Slopes are 2 to 50 percent. The vegetation is conifer-hardwood forest and an understory of brush, forbs, and sparse grass. Elevation ranges from 2,000 to 4,000 feet. The annual rainfall is 48 to 58 inches, and the average annual air temperature is about 56° F. The frost-free season is 140 to 230 days.

In a representative profile the uncultivated surface layer is littered with such forest debris as pine needles, oak leaves, and other vegetative material. Similar material below the surface becomes more decomposed as depth increases. The mineral surface layer is about 21 inches of dark-brown, and yellowish-red loam and heavy loam. Reaction is slightly acid and medium acid. The subsoil is about 43 inches of yellowish-red and reddish-yellow heavy loam to heavy clay loam and clay. Reaction in the subsoil is medium acid. Weathered andesitic tuff and conglomerate is at a depth of about 64 inches.

Permeability is moderately slow in these soils. Effective rooting depth is 48 to 60 inches or more.

The Aiken soils are generally used for timber production. Small acreages are used for pasture, grazing, or deciduous orchards.

Figure 3.—Severe sheet erosion in abandoned apple orchard on Aiken loam.

Representative profile of Aiken loam, 2 to 9 percent slopes, 4½ miles east-northeast of Grass Valley, on the north side of Lower Banner Road, 1,600 feet west of the intersection of Banner Mountain Road and Lower Banner Mountain Road, 500 feet east and 120 feet north of the west quarter corner of sec. 21, T. 16 N., R. 9 E.:

O1 & O2—4 inches to 0, fresh pine needles, twigs, litter, duff, and partly decomposed organic matter; abrupt, smooth boundary.

A1—0 to 11 inches, brown or dark-brown (7.5YR 4/4) loam, dark reddish brown (5YR 3/3) when moist; moderate, fine and medium, granular structure; soft, friable, nonsticky and nonplastic; many very fine and fine and common medium and coarse roots; many very fine interstitial pores; many very fine and fine and common medium shot; slightly acid; clear, wavy boundary.

A3—11 to 21 inches, yellowish-red (5YR 4/6) heavy loam, yellowish red (5YR 4/6) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine, fine, medium, and coarse roots; many very fine interstitial and common very fine tubular pores; few thin clay films in pores and as stains on mineral grains; common very fine, fine, and medium shot; medium acid; clear, wavy boundary.

B1t—21 to 29 inches, yellowish-red (5YR 5/6) heavy loam, dark red (2.5YR 3/6) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, sticky and plastic; few very fine and fine and common medium and coarse roots; many very fine interstitial and common very fine tubular pores; few thin clay films in pores and as stains on mineral grains; common fine shot; medium acid; clear, wavy boundary.

B21t—29 to 42 inches, yellowish-red (5YR 5/6) heavy clay loam, dark red (2.5YR 3/6) when moist; massive; slightly hard, firm, sticky and plastic; few very fine and fine and common medium and coarse roots; con..on very fine interstitial and common very fine and fine tubular pores; common thin clay films in pores, as bridges, and as stains on mineral grains; common fine shot; medium acid; clear, wavy boundary.

B22t—42 to 52 inches, yellowish-red (5YR 5/6) heavy clay loam, yellowish red (5YR 4/6) when moist; massive; hard, firm, sticky and plastic; very few very fine and fine and few medium and coarse roots; common very fine interstitial and common very fine and fine tubular pores; many moderately thick clay films in pores and as bridges; common fine shot; medium acid; clear, wavy boundary.

B3—52 to 64 inches, reddish-yellow (7.5YR 6/6) clay loam, reddish brown (5YR 4/4) when moist; massive; hard, firm, slightly sticky and plastic; very few very fine and fine and few medium and coarse roots; common very fine and few fine tubular pores; many thin and moderately thick clay films in pores, as bridges, and as stains on mineral grains; medium acid; clear, wavy boundary.

C 64 inches, light yellowish brown (10YR 6/4) strongly weathered andesitic tuff and conglomerate; massive; very strongly acid.

The A1 horizon ranges from brown to dark-brown loam or clay loam. It is slightly acid or medium acid. The B2t horizon ranges from yellowish red to dark red in color and from heavy clay loam to clay in texture. It is medium acid to very strongly acid, and the acidity increases with depth.

It is structureless (massive) or has subangular blocky structure. The B3 horizon is clay loam or heavy clay loam in texture and medium acid or strongly acid in reaction.

Weathered andesitic cobblestones make up as much as 35 percent of the soil material in the profile. Shot 1 to 2 millimeters in diameter is present throughout the soil in places and is common above the B2 horizon. Most of the shot is magnetic when dry. Depth to weathered andesitic conglomerate ranges from 4 to more than 8 feet, but it generally is at a depth of 5 to 7 feet.

Aiken loam, 2 to 9 percent slopes (AfB).—This undulating and gently rolling sloping soil is on mountainous uplands, generally those capped by andesitic conglomerate. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, Iron Mountain cobbly loam, and McCarthy cobbly loam.

Runoff is slow to medium on this soil. The hazard of erosion is slight to moderate. Available water holding capacity is 8 to 12 inches.

This Aiken soil is generally used for timber production, but some of the more open areas are used for limited grazing. Some small areas have been planted to deciduous orchards. Erosion is not a serious hazard, because of the gentle slopes and the relative stability of this soil. Capability unit IIe–1 (22).

Aiken loam, 9 to 15 percent slopes (AfC).—This rolling soil is on ridgetops and side slopes of andesitic flows. The soil material throughout the profile is as much as 10 percent cobblestones in places.

Included with this soil in mapping are small areas of Aiken cobbly loam, Cohasset cobbly loam, Cohasset loam, and McCarthy cobbly loam.

Runoff is medium on this soil. The hazard of erosion is slight to moderate. Available water holding capacity is 8 to 12 inches.

This Aiken soil is used mostly for timber production. Small cleared areas are used for grazing or deciduous orchards. Capability unit IIIe–1 (22).

Aiken loam, 15 to 30 percent slopes (AfD).—This hilly soil is on ridges and adjacent sides of andesitic flows. The soil material is generally less than 10 percent cobblestones.

Included with this soil in mapping are small areas of Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, and McCarthy cobbly loam.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high. Available water holding capacity is 8 to 12 inches.

This Aiken soil is used mostly for timber production, but small open areas are used for grazing or deciduous orchards. Capability unit IVe–1 (22).

Aiken loam, 30 to 50 percent slopes (AfE).—This steep soil is on sides of andesitic flows. The soil material is as much as 10 percent cobblestones in places.

Included with this soil in mapping are small areas of Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, and McCarthy cobbly loam.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high.

This Aiken soil is used for timber production and limited grazing. Capability unit VIe–1 (22).

Aiken cobbly loam, 2 to 30 percent slopes (AgD).—This undulating to hilly soil is on ridgetops and the sides of andesitic flows. The soil material throughout the profile is about 15 to 35 percent cobblestones.

Included with this soil in mapping are small areas of Aiken loam, Cohasset loam, Cohasset cobbly loam, Iron Mountain cobbly loam, and McCarthy cobbly loam.

Runoff is slow to medium on this soil, depending upon the slope. The hazard of erosion is slight to moderate. Available water holding capacity is 7 to 10 inches.

This Aiken soil is used mostly for timber production, but the more open areas are used for limited grazing. Some small areas where slopes are more gentle have been planted to deciduous orchards. Capability unit IVe–1 (22).

Aiken cobbly loam, 30 to 50 percent slopes (AgE).—This steep soil is on sides of andesitic flows. It has a profile similar to that described as representative for the series, but the soil material throughout the profile is generally 15 to 35 percent cobblestones.

Included with this soil in mapping are small areas of Aiken loam, Cohasset loam, Cohasset cobbly loam, McCarthy cobbly loam, and Iron Mountain cobbly loam.

Runoff is medium to rapid on this soil. The hazard of erosion is high. Available water holding capacity is 7 to 10 inches.

This Aiken soil is used mostly for timber production. It is also used for limited grazing. Capability unit VIe–1 (22).

Alluvial Land, Clayey

Alluvial land, clayey (Ao) is a miscellaneous land type consisting of narrow areas of alluvial material deposited along small stream channels and drainageways. This moderately well drained to poorly drained material formed in fine-textured alluvium derived dominantly from metabasic and granitic rock. This land type is nearly level to strongly sloping. Slopes are 0 to 15 percent. Elevation ranges from 300 to 3,500 feet.

The surface layer is mostly dark-gray to dark grayish-brown clay loam to clay overlain in places by 3 to 10 inches of sandy loam or loam. Depth is mostly 30 to 45 inches. The vegetation is annual grasses and forbs, including soft chess, ripgut brome, filaree, wild oats, lupine, annual clover, and yellow star thistle.

Permeability is moderately slow to very slow in this land type. Runoff is slow. This land is sometimes flooded during the rainy season.

This land type is used for winter and spring pasture and for range. A very small acreage is irrigated. Capability unit IIIw–5 (18, 22).

Alluvial Land, Loamy

Alluvial land, loamy (Am) is a miscellaneous land type consisting of narrow areas of recent alluvial material that has been deposited along stream channels and drainageways. These well-drained to poorly drained areas formed in loamy material from different

rock sources. They are nearly level to strongly sloping. Slopes range from 0 to 15 percent. Elevation ranges from 300 to 4,000 feet.

This land is generally from 30 to 45 inches deep to gravel, cobblestones, or underlying bedrock. It is stratified coarse sandy loam to loam and contains some gravel-size fragments in places. Vegetation is annual grasses and forbs, including soft chess, ripgut brome, filaree, wild oats, lupine, and annual clover (fig. 4).

Runoff is slow in this land type. Permeability is moderate. Flooding occurs as overflow from streams during or after heavy rain.

This land type is used mostly for winter and spring pasture or range. Some small areas could be irrigated, but this is generally not economical. Capability unit IIIw–8 (18, 22).

Argonaut Series

The Argonaut series consists of well-drained soils underlain by metabasic or basic rock. These soils are gently sloping to moderately steep and are on uplands. Slopes are often concave and range from 2 to 30 percent. The vegetation is mostly annual grasses and forbs, and areas of oak, digger pine, and brush. Wiregrass, sedge, and some stipa are also present. Elevation ranges from 300 to 2,500 feet. The annual rainfall is 26 to 50 inches, and the average annual air temperature is about 60° F. The frost-free season is 235 to 260 days.

In a representative profile the surface layer is about 2 inches of brown gravelly loam. Reaction is slightly acid. The upper part of the subsoil is about 8 inches of reddish-brown gravelly loam. Reaction is medium acid. The middle 7 inches of the subsoil is reddish-brown gravelly clay. Reaction is slightly acid. The lower 11 inches of the subsoil is light yellowish-brown clay loam and weathered diabase. Reaction is slightly acid. Weathered basic rock is at a depth of about 28 inches.

Permeability is very slow in these soils. Effective rooting depth is 18 to 36 inches. Some plant roots are restricted by the gravelly clay subsoil. Available water holding capacity is 2.5 to 4 inches.

The Argonaut soils are used mostly for annual range, but small acreages are used for irrigated pasture and improved dry pasture.

Representative profile of Argonaut gravelly loam, 2 to 30 percent slopes, 11½ miles west of Grass Valley and 900 feet southeast of the intersection of State Route No. 20 and Mooney Flat Road, 600 feet east and 150 feet south of the northwest corner of sec. 35, T. 16 N., R. 6 E.:

A1—0 to 2 inches, brown (7.5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) when moist; weak, very thick, platy structure; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; slightly acid; clear, wavy boundary.

B1—2 to 10 inches, reddish-brown (5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) when moist; massive; slightly hard, friable, sticky and plastic; few very fine and common medium roots; common thin clay films as bridges between mineral grains and as stains on mineral grains; few moderately

Figure 4.—Area of Alluvial land, loamy.

thick clay films in pores; 30 percent coarse gravel and cobblestones; medium acid; abrupt, wavy boundary.

B2t—10 to 17 inches, reddish-brown (5YR 4/4) gravelly clay, reddish brown (5YR 4/4) when moist; moderate, medium and coarse, prismatic structure; hard, firm, sticky and very plastic; few very fine and common medium roots; common very fine and fine tubular and interstitial pores; many thick clay films in pores; slightly acid; clear, wavy boundary.

B3t—17 to 28 inches, light yellowish-brown (10YR 6/4) clay loam and weathered diabase, yellowish brown (10YR 5/6) when moist; massive; very hard, firm, sticky and plastic; very few very fine and fine roots; few very fine and fine interstitial pores and many very fine and fine tubular pores; few thin and moderately thick clay films in pores; slightly acid; gradual, smooth boundary.

R—28 inches, weathered diabase.

The A horizon ranges from brown to reddish-brown loam or gravelly loam. It is slightly acid or medium acid. The B2t horizon ranges from reddish brown or yellowish red to brown or pale brown in color and from clay to gravelly clay in texture. It is neutral or slightly acid. Depth to the B2t horizon ranges from 10 to 20 inches. A "stone line" of hard broken rock fragments commonly is between the A and B horizons. Cobblestones make up 0 to 5 percent of the soil material in the profile, and gravel makes up 5 to 30 percent. Depth to bedrock ranges from 18 to 36 inches.

Argonaut gravelly loam, 2 to 15 percent slopes (ArC).—This gently sloping to strongly sloping soil is in and around depressions or swales and on broad ridges. Rock outcrops cover less than 10 percent of the surface area.

Included with this soil in mapping are small areas of Auburn loam and Sobrante loam. Also included are small, poorly drained or somewhat poorly drained areas near springs or seeps.

Runoff is slow to medium on this soil. The hazard of erosion is slight to moderate. Effective rooting depth is somewhat restricted by the gravelly clay subsoil, but perennial grass roots can extract some moisture from the subsoil.

This Argonaut soil is used mostly for annual range, but small areas are used for improved dry pasture or irrigated pasture where water is available. Because of the gravelly clay subsoil, a perched water table forms in places during the rainy season or if too much water is applied at one time during irrigation. Forage remains greener longer in spring because of the higher water holding capacity of the clay subsoil and the very slow permeability. Capability unit IVe–3 (18).

Argonaut-Rock outcrop complex, 2 to 30 percent slopes (AsD).—The Argonaut soil in this complex is gently sloping to moderately steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop. The Argonaut soil has the profile described as representative for the Argonaut series.

Included in mapping are small areas of Auburn loam, Rescue loam, and Sobrante loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate. Effective rooting depth is somewhat restricted by the subsoil, but perennial grass roots can extract some moisture from the clay.

The Argonaut soil in this complex is used for annual range. It is too rocky to be used for improved pasture. Capability unit VIs–1 (18).

Auberry Series

The Auberry series consists of well-drained soils underlain by weathered granodiorite. These soils are moderately sloping to steep and are on the middle and lower parts of foothills. Slopes are 5 to 50 percent. The vegetation is mostly annual grasses and forbs and oak, but scattered areas are in ponderosa and digger pine. Elevation ranges from 400 to 1,600 feet. The annual rainfall is 20 to 40 inches, and the average annual air temperature is about 60° F. The frost-free season is 235 to 260 days.

In a representative profile the surface layer is about 14 inches of brown or dark-brown sandy loam. Reaction is slightly acid and medium acid. The subsoil is about 26 inches of yellowish-brown and light yellowish-brown heavy sandy loam, sandy clay loam, and sandy loam. Reaction in the subsoil is medium acid and slightly acid. Weathered coarse-grained granodiorite is at a depth of about 40 inches.

Permeability is moderate in these soils. Effective rooting depth is 36 to 46 inches. Available water holding capacity is 5 to 7 inches.

The Auberry soils are used for annual range, irrigated pasture, and improved dry pasture.

Representative profile of Auberry sandy loam, 5 to 15 percent slopes, 9 miles south-southwest of Grass Valley and ¼ mile west of Dry Creek on the west side of McCourtney Road, 1,320 feet east and 500 feet north of the west quarter corner of sec. 36, T. 15 N., R. 7 E.:

A11—0 to 5 inches, dark-brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) when moist; moderate, medium and coarse, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine and fine interstitial pores; slightly acid; clear, wavy boundary.

A12—5 to 14 inches, brown (10YR 5/3) sandy loam, dark brown (7.5YR 4/4) when moist; weak, coarse and very coarse, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine and medium roots; common very fine interstitial pores; medium acid; clear, wavy boundary.

B1t—14 to 22 inches, yellowish-brown (10YR 5/4) heavy sandy loam, strong brown (7.5YR 5/6) when moist; massive; hard, firm, slightly sticky and nonplastic; very few very fine and fine and common medium and coarse roots; common very fine interstitial pores; medium acid; clear, wavy boundary.

B2t—22 to 27 inches, light yellowish-brown (10YR 6/4) sandy clay loam, strong brown (7.5YR 5/6) when moist; massive; hard, firm, slightly sticky and slightly plastic; very few very fine and fine and common medium and coarse roots; few very fine tubular pores; few moderately thick clay films in pores, as bridges, and on mineral grains; medium acid; clear, wavy boundary.

B3—27 to 40 inches, light yellowish-brown (10YR 6/4) sandy loam that has dark yellowish-brown (10YR 4/6) clay films, dark brown (7.5YR 4/4) when moist; massive; hard, firm, slightly sticky and nonplastic; very few very fine, fine, medium, and coarse roots; very few very fine pores; common moderately thick clay films in pores and as bridges; slightly acid; gradual, wavy boundary.

C—40 inches, weathered granodiorite.

The A horizon ranges from brown or dark brown to dark yellowish brown or yellowish brown. It is slightly acid or

medium acid. The B2t horizon ranges from light yellowish brown to dark yellowish brown. It is slightly acid or medium acid. The B3 horizon is sandy loam or coarse sandy loam. The C horizon is light brown or pale brown. The presence of mica or light and dark mineral grains commonly is very apparent in the B2t, B3, and C horizons. Cobblestone-size fragments make up 5 to 10 percent of the soil material in the profile in places. Depth to weathered granodiorite ranges from 36 to 46 inches.

Auberry sandy loam, 5 to 15 percent slopes (AtC).—This soil is moderately sloping and strongly sloping. About half of this soil is 2 to 10 percent rock outcrops and has slopes of 2 to 5 percent in places. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Sierra sandy loam and Shenandoah sandy loam.

Runoff is slow to medium on this soil. The hazard of erosion is slight to moderate.

This Auberry soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IVe–1 (18).

Auberry-Rock outcrop complex, 15 to 30 percent slopes (AuD).—The Auberry soil in this complex is moderately steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 30 to 100 feet apart. As much as 10 percent of the soil material is cobblestone-size fragments in places.

Included in mapping are small areas of Ahwahnee sandy loam, Sierra sandy loam, and Shenandoah sandy loam.

Runoff is medium to rapid. The hazard of erosion is high.

This complex is used mostly for annual range, but some areas are used for improved dry pasture. Capability unit VIs–1 (18).

Auberry-Rock outcrop complex, 30 to 50 percent slopes (AuE).—The Auberry soil in this complex is steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop in exposures that are about 30 to 100 feet apart.

Included in mapping are small areas of Ahwahnee sandy loam and Sierra sandy loam.

Runoff is rapid. The hazard of erosion is very high.

This complex is used for annual range. Capability unit VIIs–1 (18).

Auburn Series

The Auburn series consists of well-drained soils underlain by weathered diabase and metabasic rock. These soils are undulating to steep and are on mountainous uplands of the middle and lower parts of foothills. Slopes are 2 to 50 percent. The vegetation is mostly annual grasses and forbs and oak, but scattered areas of digger pine and brush are also present. Elevation ranges from 300 to 1,800 feet. The annual rainfall is 26 to 35 inches, and the average annual air temperature is about 60° F. The frost-free season ranges from 235 to 265 days.

In a representative profile the surface layer is about 9 inches of brown and reddish-brown loam and heavy loam. The subsoil is about 7 inches of yellowish-red light clay loam. Weathered diabase or metabasic rock is at a depth of about 16 inches. Reaction is slightly acid throughout the profile.

Permeability is moderate in these soils. Effective rooting depth is 14 to 27 inches. Available water holding capacity is 2 to 4 inches.

The Auburn soils are used mostly for annual range. A few small areas are used for irrigated pasture and improved dry pasture.

Representative profile of Auburn loam, 2 to 30 percent slopes, 1¼ miles south-southeast of the old Spenceville site, 1 mile south of Dry Creek, 50 feet south and 1,320 feet west of the north quarter corner of sec. 1, T. 14 N. R. 6 E.:

A11—0 to 1 inch, brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) when moist; weak, fine and medium, granular structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine interstitial pores; slightly acid; abrupt, smooth boundary.

A12—1 to 9 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; many very fine tubular and interstitial pores; slightly acid; clear, wavy boundary.

B2—9 to 16 inches, yellowish-red (5YR 4/6) light clay loam, dark red (2.5YR 3/6) when moist; weak, fine and medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine tubular and interstitial pores; common thin clay films on ped faces, in pores, and as bridges between mineral grains; slightly acid; clear, wavy boundary.

C—16 inches, yellowish-brown (10YR 5/4) and pale-yellow (5Y 7/3) weathered metabasic rock that has red (2.5YR 4/6) clay films, light olive brown (2.5Y 5/4) and has red (2.5YR 4/8) clay films when moist; massive; very hard; moderately thick clay films in fracture planes; slightly acid.

The A horizon ranges from brown or reddish brown to yellowish red in color and from loam to gravelly loam in texture. The B2 horizon is generally interrupted by bedrock. The C horizon is weathered diabase or metabasic rock that is light yellowish brown, yellowish brown, light brown, pale yellow, brown, or reddish yellow in color. Thin or moderately thick clay films are present in places in the fracture planes of the C horizon.

Fine angular gravel that ranges from few to as much as 25 percent of the soil material is present throughout the profile in places. Part of most pedons have a lithic contact within 20 inches. Depth to weathered or fractured bedrock ranges from 14 to 27 inches and varies within short distances.

Auburn loam, 2 to 30 percent slopes (AvD).—This undulating to hilly soil is on mountainous uplands (fig. 5). Rock outcrops cover less than 10 percent of the surface area.

Included with this soil in mapping are small areas of Sobrante loam, Rescue loam, and Argonaut gravelly loam.

Runoff is slow to medium on this soil. The hazard of erosion is slight to moderate, depending upon soil depth and slope.

This Auburn soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IVe–8 (18).

Auburn-Argonaut complex, 2 to 15 percent slopes (AwC).—The soils in this complex are undulating to rolling and are on topography where slopes are concave, on broad ridges, and in swales and drainageways

Figure 5.—Area of Auburn loam, 2 to 30 percent slopes.

in the region of oak and grass in the western part of the Nevada County Area. About 60 percent of this complex is Auburn soils and about 35 percent is Argonaut soils. Auburn soils are on the ridges, and Argonaut soils are on concave slopes and in swales and drainageways. Rock outcrops cover as much as 10 percent of the surface area.

Included with these soils in mapping, and making up about 5 percent of the complex, are small areas of Sobrante loam and some seeped areas in swales.

Runoff is slow to medium on the soils in this complex. The hazard of erosion is slight to moderate.

The soils in this complex are used mostly for winter and spring dry pasture and range, but limited areas are used for irrigated pasture. Capability unit IVe–8 (18).

Auburn-Rock outcrop complex, 2 to 30 percent slopes (AxD).—The Auburn soil in this complex is undulating to hilly and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop. The Auburn soil has the profile described as representative for the Auburn series.

Included in mapping are small areas of Argonaut gravelly loam, Sobrante loam, and Rescue loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, depending upon slope.

This complex is used for annual range and, to some extent, for irrigated and improved dry pasture. Capability unit VIs–1 (18).

Auburn-Rock outcrop complex, 30 to 50 percent slopes (AxE).—The Auburn soil in this complex is steep and is on the sides of the more prominent hills and the creek channels and drainageways. About 10 to 25 percent of this complex is Rock outcrop. In places the soil mapped in this complex is slightly shallower than in Auburn-Rock outcrop complex, 2 to 30 percent slopes.

Included in mapping are small areas of Sobrante loam and Argonaut gravelly loam.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This complex is used for annual range. Capability unit VIIs–1 (18).

Boomer Series

The Boomer series consists of well-drained soils underlain by weathered basic rock. These soils are gently rolling to steep and are on the middle part of foothills. Slopes are 5 to 50 percent. The vegetation is ponderosa pine, black and live oak, brush, and forbs and annual grasses. Elevation ranges from 1,000 to 2,200 feet. The annual rainfall is 30 to 45 inches. Summer thundershowers occur infrequently. The average annual air temperature is 56° to 58° F. The frost-free season ranges from 200 to 260 days.

In a representative profile the surface layer is about 11 inches of brown, dark-brown, and reddish-brown light loam and loam. Reaction is medium acid and slightly acid. The subsoil is about 26 inches of red-

dish-brown heavy loam and yellowish-red clay loam and light clay loam. Reaction in the subsoil is slightly acid. The substratum is reddish-yellow loam mixed with weathered diabase. Reaction in this layer is slightly acid. Fractured diabase is at a depth of about 47 inches.

Permeability is moderately slow in these soils. Effective rooting depth is 40 to 60 inches or more. Available water holding capacity is 6 to 10 inches.

The Boomer soils are used for annual range, improved dry pasture, and irrigated pasture. They are also used for timber production to a limited extent.

Representative profile of Boomer loam, 15 to 30 percent slopes, 7½ miles west-southwest of Grass Valley and 0.4 mile northwest of the intersection of Indian Springs and Spenceville Roads, 500 feet east and 400 feet south from the center of sec. 4, T. 15 N., R. 7 E.:

A11—0 to 2 inches, brown or dark-brown (7.5YR 4/4) light loam, dark reddish brown (5YR 3/4) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; texture reflects high organic-matter content; many very fine roots; many very fine interstitial pores; medium acid; abrupt, wavy boundary.

A12—2 to 6 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; massive, somewhat compacted; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; slightly acid; clear, wavy boundary.

A3—6 to 11 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; massive; somewhat compacted; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial pores; some pores are old root channels; few thin clay films in pores and as bridges between mineral grains; slightly acid; clear, wavy boundary.

B1—11 to 18 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (2.5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine, medium, and coarse roots; common very fine tubular and interstitial pores; few thin clay films in pores and as bridges between mineral grains; slightly acid; clear, wavy boundary.

B2t—18 to 29 inches, yellowish-red (5YR 4/6) clay loam, dark red (2.5YR 3/6) when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine and common medium and coarse roots; common very fine tubular and interstitial pores; common moderately thick clay films on ped faces and in pores; slightly acid; clear, wavy boundary.

B3t—29 to 37 inches, yellowish-red (5YR 5/6) light clay loam that has red (2.5YR 4/8) clay films, yellowish red (5YR 4/8) and has dark-red (2.5YR 3/6) clay films when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine and common medium and coarse roots; few very fine pores; common moderately thick clay films on ped faces and in pores; slightly acid; gradual, wavy boundary.

C—37 to 47 inches, reddish-yellow (7.5YR 6/6) loam and weathered diabase, strong brown (7.5YR 5/6) when moist; massive; hard, firm, slightly sticky and slightly plastic; red (2.5YR 4/8) clay films along fracture planes; slightly acid; clear, wavy boundary.

R—47 inches, hard fractured diabase.

The A horizon has structure ranging from granular to subangular blocky or is structureless (massive). The B2t horizon ranges from reddish brown to yellowish red. This horizon is slightly acid or medium acid in reaction. It is structureless (massive) or has subangular blocky structure. The B3t horizon is yellowish-red to pale-brown loam or light clay loam. Depth to hard bedrock ranges from 40 to more than 60 inches.

Boomer loam, 5 to 15 percent slopes (BoC).—This soil is gently rolling or rolling. Rock outcrops cover less than 10 percent of the surface area.

Included with this soil in mapping are small areas of Josephine loam, Sites loam, Sites very stony loam, Sobrante loam, and Rescue loam.

Runoff is slow to medium on this soil. The hazard of erosion is slight to moderate.

This Boomer soil is used for annual range, irrigated pasture, and, to a limited extent, for timber production. Capability unit IIIe–1 (22).

Boomer loam, 15 to 30 percent slopes (BoD).—This hilly soil is on mountainous uplands of the middle part of foothills. Rock outcrops cover less than 10 percent of the surface area. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Rescue loam, Sobrante loam, Josephine loam, Sites loam, and Sites very stony loam.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high.

This Boomer soil is used for annual range, irrigated pasture, and, to a limited extent, for timber production. Capability unit IVe–1 (22).

Boomer-Rock outcrop complex, 5 to 30 percent slopes (BrD).—The Boomer soil in this complex is gently rolling to hilly. About 10 to 25 percent of this complex is Rock outcrop. Stones make up 3 to 15 percent of the surface area and the profile of the soils that have slopes of more than 15 percent. Gravel makes up as much as 10 percent of the soil material in the profile in places.

Included in mapping are small areas of Josephine loam, Sites very stony loam, Sites loam, Sobrante loam, and Rescue loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, depending upon slope.

This complex is used mostly for annual range. It is also used for timber production to a limited extent. Capability unit VIs–1 (22).

Boomer-Rock outcrop complex, 30 to 50 percent slopes (BrE).—The soil in this complex is steep. About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 30 to 100 feet apart. Stones cover from 3 to 15 percent of the surface area and are in the profile in places. Gravel makes up as much as 10 percent of the soil material in the profile in places.

Included in mapping are areas of Boomer loam, Rescue loam, Sobrante loam, Sites loam, and Sites very stony loam.

Runoff is medium to rapid. The hazard of erosion is high.

This complex is used for annual range and, to a limited extent, for timber production. Capability unit VIs–1 (22).

Chaix Series

The Chaix series consists of well-drained soils underlain by weathered granodiorite. These soils are on mountainous uplands. Slopes are 5 to 75 percent. The vegetation is mostly ponderosa pine, incense cedar, black oak, canyon live oak, bear clover, manzanita, ceanothus, and annual grasses. Elevation ranges from 1,200 to 3,000 feet. The annual rainfall is 35 to 50 inches, and the average annual air temperature is 56° to 58° F. The frost-free season ranges from 175 to 225 days.

In a representative profile the surface layer is about 8 inches of light-gray and very pale brown sandy loam. The subsoil is 16 inches of very pale brown heavy sandy loam. The substratum is 10 inches of variegated very pale brown and white light sandy loam. Reaction is medium acid throughout the profile. Weathered granodiorite is at a depth of 34 inches.

Permeability is moderately rapid in the subsoil. Effective rooting depth is 20 to 40 inches. Available water holding capacity is 3 to 5 inches.

The Chaix soils are used for timber production and grazing, improved dry pasture, and watershed.

Representative profile of Chaix sandy loam, 15 to 50 percent slopes, eroded, 12 miles north of Grass Valley, 1,250 feet west and 100 feet north of the southeast corner of sec. 28, T. 18 N., R. 8 E.:

A11—0 to 3 inches, light-gray (10YR 7/2) sandy loam, brown (10YR 4/3) when moist; moderate, fine and medium, granular structure; soft, friable, nonsticky and nonplastic; many very fine and very few fine roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

A12—3 to 8 inches, very pale brown (10YR 7/3) sandy loam, dark yellowish brown (10YR 4/4) when moist; weak, fine and medium, granular structure; slightly hard, friable, slightly sticky and nonplastic; few very fine, very few fine, and many medium and coarse roots; many very fine interstitial and few very fine tubular pores; medium acid; clear, wavy boundary.

B2—8 to 24 inches, very pale brown (10YR 7/3) heavy sandy loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, slightly sticky and nonplastic; very few fine and many medium and coarse roots; many very fine interstitial and common very fine tubular pores; medium acid; clear, wavy boundary.

C1—24 to 34 inches, variegated very pale brown and white (10YR 7/4, 8/4, 8/2) light sandy loam, very pale brown (10YR 7/4) and yellow (10YR 7/6) and has yellowish-red (5YR 5/8) clay films when moist; massive; hard, firm, nonsticky and nonplastic; many medium and coarse roots; few thin clay films as colloid stains, as bridges, and as stains on mineral grains; medium acid.

C2—34 inches, weathered granodiorite.

The A horizon ranges from slightly acid to medium acid in reaction. The B2 horizon ranges from light gray to very pale brown in color and from medium acid to strongly acid in reaction. The C horizon is white, very pale brown, light brown, or reddish yellow. Mica or light and dark mineral grains are very apparent in the C horizon. The original rock structure is recognizable. Coarse gravel and cobblestone-size fragments make up as much as 10 percent of the soil material in the profile in places. Depth to weathered granodiorite ranges from 20 to 40 inches.

Chaix sandy loam, 15 to 50 percent slopes, eroded (CdE2).—This moderately steep and steep soil is on mountainous uplands. Rock outcrops cover 2 to 10 percent of the surface area. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Cohasset cobbly loam, Hotaw sandy loam, Hoda sandy loam, and Musick sandy loam. Also included are areas of Chaix-like soils that are more than 40 inches deep to weathered parent rock.

Runoff is medium to rapid on this soil. The hazard of erosion is high.

This Chaix soil is used for annual range, improved dry pasture, and timber production. Capability unit VIe–1 (22).

Chaix-Hotaw complex, 5 to 15 percent slopes, eroded (ChC2).—About 55 percent of this complex is Chaix sandy loam, and about 40 percent is Hotaw sandy loam. The other 5 percent is small areas of the included soils Hoda sandy loam and Musick sandy loam. Rock outcrops cover 2 to 10 percent of the surface area. In about 25 to 50 percent of the area the surface layer has been lost as a result of erosion.

Runoff is medium on these soils. The hazard of erosion is moderate to high.

The soils in this complex are used for timber production and for grazing. Capability unit IVe–1 (22).

Chaix-Hotaw complex, 15 to 30 percent slopes, eroded (ChD2).—The soils in this complex are moderately steep. They are underlain by weathered granodiorite and, in places, by a mixture of quartzite and granodiorite. About 55 percent of this complex is Chaix sandy loam, and about 40 percent is Hotaw sandy loam. The other 5 percent is included soils. Rock outcrops cover 2 to 10 percent of the surface area and are about 100 to 300 feet apart.

Included with these soils in mapping are small areas of Hoda sandy loam and Musick sandy loam.

Runoff is medium to rapid on these soils. The hazard of erosion is high.

The soils in this complex are used for timber production. They are also used for grazing to a limited extent. Most areas have been burned over and have a cover of brush. Capability unit VIe–1 (22).

Chaix-Hotaw complex, 30 to 50 percent slopes, eroded (ChE2).—About 55 percent of this complex is Chaix sandy loam, and about 40 percent is Hotaw sandy loam. The other 5 percent is small areas of the included soils Hoda sandy loam and Musick sandy loam. Rock outcrops cover 10 to 25 percent of the surface area. About 25 to 50 percent of the surface layer has been removed by erosion.

Runoff is rapid on these soils. The hazard of erosion is very high.

The soils in this complex are used for timber production and grazing. Capability unit VIs–1 (22).

Chaix-Rock outcrop complex, 30 to 75 percent slopes (CxF).—About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 30 to 100 feet apart. This complex is slightly eroded.

Included in mapping are small areas of Chaix sandy loam, Cohasset cobbly loam, Hoda sandy loam, Hotaw sandy loam, and Musick sandy loam.

Runoff is rapid. The hazard of erosion is very high.

This complex is used mostly for watershed and timber production. It is also used for grazing to a limited extent. Capability unit VIIs–1 (22).

Chaix Series, Thick Solum Variant

The Chaix series, thick solum variant, consists of well-drained soils underlain by weathered gabbrodiorite or gabbrodioritelike rock. These soils are gently rolling to steep and are on uplands of the middle part of foothills. Slopes are 5 to 50 percent. The vegetation is open stands of ponderosa pine, digger pine, manzanita, ceanothus, blue oak, live oak, scattered black oak, and grasses. Elevation ranges from 1,300 to 2,400 feet. The annual rainfall is 35 to 55 inches. Summer thundershowers occur infrequently. The average annual air temperature is 55° to 58° F. The frost-free season ranges from 150 to 230 days.

In a representative profile the surface layer is about 8 inches of grayish-brown very stony loam and light brownish-gray loam. Reaction is slightly acid and medium acid. The subsoil is about 26 inches of light brownish-gray heavy loam and pale-olive and light-gray clay loam. Reaction in the subsoil is medium acid. The substratum is 10 inches of variegated sandy loam. Reaction in this layer is medium acid. Weathered gabbrodiorite is at a depth of about 44 inches.

Permeability is moderately slow in these soils. Effective rooting depth is 24 to 48 inches. Available water holding capacity is 4 to 8 inches.

The Chaix variant soils are used for watershed, grazing, and irrigated pasture.

Representative profile of Chaix very stony loam, thick solum variant, 15 to 30 percent slopes, 3 miles west of Nevada City and 1½ miles southwest of the intersection of State Route No. 49 and Newtown Road, 1,500 feet south and 1,000 feet east of the west quarter corner of sec. 10, T. 16 N., R. 8 E.:

O1 & O2—1 inch to 0, litter and partly decomposed organic matter.

A1—0 to 5 inches, grayish-brown (2.5Y 5/2) very stony loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and coarse, granular structure; soft, friable, slightly sticky and slightly plastic; many very fine and fine and common medium roots; many very fine and fine interstitial and common very fine tubular pores; slightly acid; clear, wavy boundary.

A3—5 to 8 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and common medium and coarse roots; many very fine interstitial and common very fine tubular pores; medium acid; clear, smooth boundary.

B1t—8 to 17 inches, light brownish-gray (2.5Y 6/2) heavy loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine and common medium and coarse roots; common very fine interstitial and tubular pores; medium acid; clear, smooth boundary.

B2t—17 to 28 inches, pale-olive (5Y 6/3) clay loam, olive (5Y 4/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; few very fine and fine and few medium and coarse roots; common very fine interstitial and few very fine tubular pores; few thin and moderately thick clay films as bridges between mineral grains and as colloidal stains and few thick clay films in pores; medium acid; clear, smooth boundary.

B3t—28 to 34 inches, light-gray (5Y 7/2) clay loam, olive gray (5Y 5/2) when moist; massive; hard, friable, sticky and plastic; very few very fine and fine and few medium roots; common very fine interstitial and few very fine tubular pores; few thin clay films as bridges between mineral grains and as colloidal stains; light and dark mineral grains apparent; medium acid; clear, smooth boundary.

C1—34 to 44 inches, variegated sandy loam; massive; soft, very friable, nonsticky and nonplastic; common very fine interstitial and few very fine tubular pores; few thin clay films as bridges between mineral grains and as colloidal stains; medium acid; clear, wavy boundary.

C2—44 inches, variegated weathered gabbrodiorite; more consolidated than C1 horizon.

Thin O1 and O2 horizons are present in places, depending upon extent of erosion. The A1 horizon ranges from grayish-brown or gray to light-gray clay loam or loam. It is slightly acid or medium acid. It has granular or subangular blocky structure. A light brownish-gray, light-gray, or light olive-gray A3 horizon or B1 horizon is transitional to the B2t horizon in places. Few thin to moderately thick clay films coat or bridge mineral particles in places. Depth to weathered gabbrodioritelike rock ranges from 24 to 48 inches. Gravel and cobblestone-size fragments make up from 2 to 12 percent of the soil material in the profile in places.

Chaix very stony loam, thick solum variant, 5 to 15 percent slopes (CIC).—This gently rolling to rolling soil is on mountainous uplands. The soil material throughout the profile is 2 to 12 percent gravel or cobblestone-size fragments. Stones cover about 1 to 3 percent of the surface area.

Included with this soil in mapping are small areas of Secca gravelly silt loam, Boomer loam, Dubakella gravelly loam, Sites loam, Sites very stony loam, and areas of rock outcroppings. Also included in places are areas of Chaix variant soils that have slopes of less than 5 percent and that contain essentially no stones or coarse fragments.

Runoff is slow to medium on this soil. The hazard of erosion is slight to moderate.

This Chaix soil is used for grazing, irrigated pasture, and watershed. Capability unit IVs–7 (22).

Chaix very stony loam, thick solum variant, 15 to 30 percent slopes (CID).—This hilly soil is on mountainous uplands of the middle part of foothills. Stones cover about .1 to 3 percent of the surface area. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Secca gravelly silt loam, Dubakella gravelly loam, Boomer loam, Sites loam, Sites very stony loam, and areas of rock outcroppings.

Runoff is medium to rapid on this soil. The hazard of erosion is high.

This Chaix soil is used for grazing and watershed. Areas that have fewer stones are grazed more frequently than those having more. Capability unit VIs–1 (22).

Chaix very stony loam, thick solum variant, 30 to 50 percent slopes (CIE).—This steep soil is 2 to 12 percent cobblestone- or gravel-size fragments. Stones cover .1 to 3 percent of the surface area.

Included with this soil in mapping are small areas of Secca gravelly silt loam, Dubakella gravelly loam, Boomer loam, and areas of rock outcroppings.

Runoff is rapid on this soil. The hazard of erosion is very high.

This Chaix soil is used for watershed and limited grazing. Capability unit VIs–1 (22).

Cohasset Series

The Cohasset series consists of well-drained soils underlain by cobbly andesitic conglomerate. These soils are on tabular volcanic ridges and colluvial side slopes. The soils on ridges are undulating to hilly, and those on side slopes are strongly sloping to very steep. Slopes are 2 to 75 percent. The vegetation is conifer-hardwood forest and an understory of brush, forbs, and sparse grass. Elevation ranges from 2,000 to 4,000 feet. The annual rainfall is 48 to 58 inches, and the average annual air temperature is about 56° F. The frost-free season is 140 to 230 days.

In a representative profile the surface is generally littered with such forest debris as pine needles, oak leaves, and other vegetative material. Similar material below the surface becomes more decomposed as depth increases. The mineral surface layer is about 15 inches of brown cobbly loam. Reaction is medium acid. The subsoil is about 81 inches of reddish-brown and strong-brown cobbly heavy loam, cobbly clay loam, and cobbly light clay loam. Reaction in the subsoil is medium acid and strongly acid. A substratum of weathered andesitic conglomerate is at a depth of about 96 inches.

Permeability is moderately slow in these soils. Effective rooting depth is 42 to 60 inches or more.

The Cohasset soils are used mostly for timber production. Small acreages are used for pasture, grazing, or deciduous orchards.

Representative profile of Cohasset cobbly loam, 5 to 30 percent slopes, 4 miles northeast of Grass Valley on the north side of Cooper Road, 1,950 feet east and 700 feet north of the west quarter corner of sec. 33, T. 17 N., R. 9 E.:

O1 & O2—2 inches to 0, mat of fresh pine needles, litter, and duff; abrupt, smooth boundary.

A11—0 to 2 inches, brown (7.5 YR 4/4) cobbly loam, dark reddish brown (5YR 3/2) when moist; strong, fine and medium, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and common fine and medium roots; many very fine and fine interstitial pores; medium acid; clear, wavy boundary.

A12—2 to 8½ inches, brown (7.5YR 4/4) cobbly loam, dark reddish brown (5YR 3/3) when moist; moderate, fine and medium, granular structure; slightly hard, very friable, nonsticky and nonplastic; many very fine and fine and common medium roots; many very fine and fine interstitial pores; medium acid; clear, wavy boundary.

A3—8½ to 15 inches, brown (7.5YR 4/4) cobbly loam, dark reddish brown (5YR 3/4) when moist; moderate, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; common very fine tubular and interstitial pores; few thin clay films bridging sand grains and as colloid stains on mineral grains, and common thin clay films in pores; medium acid; clear, wavy boundary.

B1 —15 to 24 inches, reddish-brown (5YR 4/4) cobbly heavy loam, dark reddish brown (5YR 3/4) when moist; moderate, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine and common medium roots; common very fine and fine tubular and interstitial pores; common thin clay films bridging sand grains and as colloid stains on mineral grains, and common moderately thick clay films in pores; medium acid; clear, wavy boundary.

B21t—24 to 37 inches, reddish-brown (5YR 4/4) cobbly light clay loam, dark reddish brown (5YR 3/4) when moist; moderate, coarse and very coarse, subangular blocky structure; hard, firm, sticky and plastic; few very fine and fine, common medium, and very few coarse roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films in pores and on ped faces; medium acid; gradual, wavy boundary.

B22t—37 to 57 inches, reddish-brown (5YR 4/4) cobbly clay loam, dark reddish brown (5YR 3/4) when moist; moderate, coarse and very coarse, angular blocky structure; hard, firm, sticky and plastic; few very fine and fine and common medium roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films in pores and on ped faces; medium acid; gradual, wavy boundary.

B23t—57 to 67 inches, reddish-brown (5YR 4/4) cobbly light clay loam, dark reddish brown (5YR 3/4) when moist; moderate, coarse and very coarse, angular blocky structure; hard, firm, sticky and plastic; few very fine and fine, common medium, and few coarse roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films in pores and on ped faces; strongly acid; gradual, wavy boundary.

B3t—67 to 96 inches, strong-brown (7.5YR 5/6) cobbly light clay loam, reddish brown (5YR 4/4) when moist; massive; hard, firm, sticky and plastic; very few medium and coarse roots; common very fine and fine tubular and interstitial pores; many moderately thick clay films bridging sand grains, in pores, and as colloid stains on mineral grains; strongly acid; gradual, wavy boundary.

C—96 inches, weathered andesitic conglomerate.

The A horizon ranges from brown or dark-brown to reddish-brown loam or heavy loam that is cobbly in places. It is slightly acid or medium acid. In some soils in this series, the A1 horizon is 10 to 30 percent cobblestones.

The B2t horizon ranges from brown or strong brown to reddish brown or yellowish red in color and from light cobbly clay loam to heavy clay loam in texture. The heavy clay loam, where present, is below a depth of 40 inches. This horizon is slightly acid to strongly acid in reaction. It is structureless (massive) or has angular blocky or subangular blocky structure.

The B3t horizon is strong-brown to light yellowish-brown or reddish-brown cobbly clay loam to heavy clay loam. In some soils in this series the B horizon is 20 to 40 percent cobblestones.

Reaction decreases with depth in Cohasset soils. Shot 1 to 2 millimeters in diameter is present throughout the soil in places and is common in the B2t horizon. Cobblestones make up less than 15 percent of the soil material in the profile of some soils. Gravel makes up 5 to 15 percent of the soil material in the profile in places. Depth to weathered andesitic conglomerate ranges from 42 to more than 96 inches.

Cohasset loam, 2 to 9 percent slopes (CmB).—This undulating or gently rolling soil is on broad ridgetops of andesitic flows. It has a profile similar to that described as representative for the series, but the surface layer and subsoil are generally less than 15 percent cobblestones.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset cobbly loam, McCarthy cobbly loam, Sites loam, and Iron Mountain cobbly loam.

Runoff is medium on this soil. The hazard of erosion is slight. Available water holding capacity is 7 to 11 inches.

This Cohasset soil is used mostly for timber production, but small open areas are used for grazing or deciduous orchards. Capability unit IIe–1 (22).

Cohasset loam, 9 to 15 percent slopes (CmC).—This soil is rolling on ridgetops or strongly sloping on side slopes of old andesitic flows. It has a profile similar to that described as representative for the series, but the soil material throughout the profile is less than 15 percent cobblestones.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset cobbly loam, McCarthy cobbly loam, Sites loam, and Iron Mountain cobbly loam.

Runoff is medium on this soil. The hazard of erosion is slight to moderate. Available water holding capacity is 7 to 11 inches.

This Cohasset soil is used mostly for timber production, but small open areas are used for grazing or deciduous orchards. Capability unit IIIe–1 (22).

Cohasset loam, 15 to 30 percent slopes (CmD).—This soil is hilly on ridges or moderately steep on adjacent side slopes of andesitic flows. It has a profile similar to that described as representative for the series, but the soil material throughout the profile is less than 10 percent cobblestones.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset cobbly loam, McCarthy cobbly loam, Sites loam, and Iron Mountain cobbly loam.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high. Available water holding capacity is 7 to 11 inches.

This Cohasset soil is used mostly for timber production, but small open areas are used for grazing or deciduous orchards. Capability unit IVe–1 (22).

Cohasset cobbly loam, 5 to 30 percent slopes (CoD).—
—This soil is moderately sloping to moderately steep and is on mountainous uplands, generally those underlain by andesitic conglomerate. Cobblestones make up 10 to 30 percent of the surface layer of this soil and 20 to 35 percent of the subsoil. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset loam, McCarthy cobbly loam, Josephine loam, Sites loam, and Iron Mountain cobbly loam. Also included are a few areas of rock outcroppings.

Runoff is medium to rapid on this soil. The hazard of erosion is slight to moderate. Available water holding capacity is 5.5 to 9 inches.

This Cohasset soil is used mostly for timber production, but some of the more open areas are used for limited grazing. Some small areas where this soil is gently sloping are used for deciduous orchards. Capability unit IVe–7 (22).

Cohasset cobbly loam, 30 to 50 percent slopes (CoE).—This steep soil is on mountainous uplands and side slopes of andesitic flows. It has a profile similar to that described as representative for the series, but the surface layer is generally 15 to 30 percent cobblestones, and the subsoil 15 to 40 percent. Depth of this soil is generally between 42 and 60 inches.

Included with this soil in mapping are small areas of Cohasset loam, McCarthy cobbly loam, and Iron Mountain cobbly loam.

Runoff is rapid on this soil. The hazard of erosion is moderate to high. Available water holding capacity is 5.5 to 9 inches.

This Cohasset soil is used mostly for timber production, but some areas are used for limited grazing. Capability unit VIe–1 (22).

Cohasset-McCarthy cobbly loams, 15 to 50 percent slopes (CsE).—The soils in this complex are hilly to steep on andesitic ridges and are moderately steep to steep on adjacent side slopes. About 55 percent of this complex is Cohasset cobbly loam, and about 35 percent is McCarthy cobbly loam. The other 10 percent is included soils. Rounded cobblestones make up 15 to 35 percent of the soil material throughout the entire profile.

Included with these soils in mapping are small areas of Aiken loam and Aiken cobbly loam and some areas of moderately sloping to strongly sloping soils. Also included, in places, are areas of gently sloping to moderately sloping Cohasset loams.

The soils in this complex are different, but have so few visible indications of differences on the surface that separation is very difficult.

Runoff is rapid on these soils. The hazard of erosion is moderate to high. Available water holding capacity is 5.5 to 9 inches in the Cohasset cobbly loam. Permeability in the McCarthy cobbly loam is moderate.

The soils in this complex are used mostly for timber production, but some areas are used for limited grazing. Capability unit VIe–1 (22).

Cohasset-McCarthy cobbly loams, 50 to 75 percent slopes (CsF).—The soils in this complex are very steep and are on mountainous uplands. About 55 percent of this complex is Cohasset cobbly loam, and about 35 percent is McCarthy cobbly loam. The other 10 percent is included soils. The soil material throughout the profile of these soils is 15 to 50 percent cobblestones.

Included with these soils in mapping are small areas of Aiken loam, Iron Mountain cobbly loam, and Horseshoe loam. In places seeps or springs are on the northern sides of the lava cap.

Runoff is rapid on these soils. The hazard of erosion is very high. McCarthy cobbly loam is moderately permeable. Cohasset cobbly loam has an available water holding capacity of 5.5 to 9 inches.

The soils in this complex are used mostly for timber production. They are also used for grazing to a very limited extent. Capability unit VIIe–1 (22).

Cut and Fill Land

Cut and fill land (Ct) is a miscellaneous land type consisting of areas that have been altered by methods

other than mining so that the soil characteristics have been completely eliminated. These cut and fill or dozed areas have been used largely as logging deck yards or lumber stack yards. In places the subsoil or parent rock is exposed. Deep accumulations of bark are present where logs have been stored before cutting. These areas commonly show much evidence of equipment traffic. Slopes are 0 to 50 percent.

This land type has no value for farming. Lumber mills, industrial sites, school sites, and commercial areas are on tracts of this land type. Capability unit VIIIs–1 (18, 22).

Dubakella Series

The Dubakella series consists of well-drained soils underlain by ultrabasic rock. These soils are gently rolling to steep on mountainous uplands. Slopes are 5 to 50 percent. The vegetation is mostly digger pine, manzanita, yerba santa, ceanothus, live oak, blue oak, cypress, and squirrel tail, and forbs. Elevation ranges from 2,200 to 2,700 feet. The annual rainfall is 46 to 54 inches, and the average annual air temperature is about 56° F. The frost-free season is 150 to 235 days.

In a representative profile the surface layer is 10 inches of brown gravelly heavy loam and gravelly clay loam. Reaction is slightly acid. The subsoil is about 11 inches of variegated dark yellowish-brown and brown very cobbly clay, and it is neutral in reaction. Weathered ultrabasic rock is at a depth of about 21 inches.

Permeability is slow in these soils. Effective rooting depth is 20 to 26 inches. Available water holding capacity is 2 to 3 inches. Perennial grass roots can extract limited moisture from the clay subsoil.

The Dubakella soils are used mostly for wildlife habitat and watershed. They are also used for grazing to a limited extent.

Representative profile of Dubakella gravelly loam, from an area of Rock outcrop-Dubakella complex, 5 to 50 percent slopes, 2½ miles north-northwest of Grass Valley, 350 feet northeast of the Deer Creek ditch and 1,000 feet south of Newtown Road, 250 feet south and 200 feet east of the north quarter corner of sec. 16, T. 16 N., R. 8 E.:

A11—0 to 2 inches, brown (7.5YR 4/4) gravelly heavy loam, dark brown (7.5YR 3/2) when moist; moderate, medium and coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; few very fine tubular and common very fine interstitial pores; few thin clay films as bridges between sand grains and as colloid stains on mineral grains; slightly acid; clear, wavy boundary.

A12—2 to 10 inches, brown (7.5YR 5/4) gravelly clay loam, dark reddish brown (5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; few very fine, very few fine, and common medium roots; common very fine and fine interstitial and few very fine and fine tubular pores; common thin clay films as bridges between sand grains and as colloid stains on mineral grains; slightly acid; clear, wavy boundary.

B2t—10 to 21 inches, variegated dark yellowish brown and brown (10YR 4/4, 7.5YR 4/4) very cobbly clay, dark yellowish brown and reddish brown (10YR 4/4, 5YR 4/4) when moist; moderate, medium and coarse, prismatic structure; hard, firm, sticky and plastic; few very fine and fine tubular and common medium roots; few very fine and fine tubular and common very fine and fine interstitial pores; continuous thick clay films on ped faces and lining pores; neutral; clear, wavy boundary.

C—21 inches, weathered ultrabasic rock; massive; many moderately thick and thick clay films on surfaces of cobblestones; neutral.

A gravel pavement generally is on the surface. The A horizon ranges from slightly acid to medium acid. It is 15 to 50 percent gravel and cobblestones. The B2t horizon generally is 30 to 50 percent gravel and cobblestones. Depth to the B2t horizon ranges from 6 to 10 inches. Reaction throughout the profile generally increases with depth. Depth to rock is 20 to 26 inches.

Dubakella soils are mapped only in complex with Rock outcrop.

Dubakella Series, Shallow Variant

The Dubakella series, shallow variant, consists of well-drained soils underlain by ultrabasic rock. These soils are undulating to steep. Slopes are 2 to 50 percent. The vegetation is digger pine, blue oak, manzanita, ceanothus, and annual grasses and forbs. A few perennials are present in places. Elevation ranges from 1,200 to 1,800 feet. The annual rainfall is 35 to 47 inches, and the average annual air temperature is about 60° F. The frost-free season is 240 to 260 days.

In a representative profile the surface layer is about 10 inches of pale-brown loam and light yellowish-brown heavy loam. Reaction in this layer is slightly acid and neutral. The subsoil is about 8 inches of brown heavy clay loam and pale-yellow clay, and it is neutral in reaction. Partly weathered serpentinized ultrabasic rock is at a depth of about 18 inches.

Permeability is very slow in these soils. Effective rooting depth is 10 to 20 inches. Available water holding capacity is 1.5 to 2.5 inches.

These soils are used for annual range, as wildlife habitat, and for watershed.

Representative profile of Dubakella loam, shallow variant, 2 to 50 percent slopes, 8½ miles south of Grass Valley, on the northwest side of Lime Kiln Road, 1,250 feet south of the north quarter corner of sec. 4, T. 14 N., R. 8 E.:

A1—0 to 3 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular and interstitial pores; slightly acid; clear, wavy boundary.

A3—3 to 10 inches, light yellowish-brown (10YR 6/4) heavy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; common very fine roots; common very fine tubular and interstitial pores; neutral; clear, wavy boundary.

B21t—10 to 14 inches, brown (7.5YR 5/4) heavy clay loam that has common, medium, distinct, pale-olive (5Y 6/3) mottles, dark brown (7.5YR 4/2) and has common, medium, distinct, olive (5Y 5/3) mottles when moist; weak, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; common very fine and few fine roots; common very fine tubular and interstitial pores; common moderately thick clay films on ped faces, in pores, and as bridges between sand grains; neutral; clear, wavy boundary.

B22t—14 to 18 inches, pale-yellow (5Y 7/3) clay that has brown (7.5YR 5/4) clay films, olive (5Y 5/3) and has dark-brown (7.5YR 4/4) clay films when moist; massive; very hard, firm, very sticky and very plastic; few very fine and fine roots; common very fine tubular and interstitial pores; common moderately thick clay films in pores and as bridges between mineral grains; neutral; clear, irregular boundary.

R—18 inches, slightly weathered serpentinized ultrabasic bedrock.

The A horizon is pale brown, light yellowish brown, or reddish brown. It is neutral to medium acid. The B2t horizon is brown, pale brown, yellowish brown, or pale yellow. It is neutral or mildly alkaline. The B2t horizon is commonly interrupted by rock outcroppings. The C horizon, where present, is underlain by slightly weathered ultrabasic rock. Gravel makes up 5 to 10 percent of the soil material in the profile in places. Depth to weathered or fractured ultrabasic bedrock ranges from 10 to 20 inches but is variable within short distances.

Dubakella, shallow variant-Rock outcrop complex, 2 to 50 percent slopes (DrE).—The Dubakella soil in this complex is the only Dubakella, shallow-variant soil mapped in the Nevada County Area. It is undulating to steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop, and the rest, except for included soils, is Dubakella loam.

Included in mapping are small areas of Auburn loam and Sobrante loam. Also included are areas that are naturally wet. The presence of wiregrass and sedges in these areas indicates poor drainage.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This complex is used for winter and spring range, as wildlife habitat, and for watershed. Capability unit VIIs–1 (18).

Granitic Rock Land

Granite rock land (Gr) is a miscellaneous land type consisting of extremely rocky or stony, granitic material on mountainous areas. Large tracts of this land type are along the South Yuba River and Deer Creek. Elevation ranges from 500 to 3,500 feet. Slopes range from 2 to 75 percent but are mostly more than 30 percent. Rock outcrops of granodiorite cover 50 to 90 percent of the surface area. Small areas of shallow to moderately deep soils are interspersed between the outcrops in places. These are generally Ahwahnee, Auberry, Chaix, Hoda, Sierra, or Musick soils. Vegetation is sparse. What there is consists of digger pine, black oak, blue oak, live oak, ponderosa pine, buckbrush, manzanita, and a few annual grasses.

Runoff is rapid or very rapid on this land type. The hazard of erosion is high to very high.

This land type is used for watershed, as wildlife habitat, and for recreation. It is generally unsuitable for most farming uses. Capability unit VIIIs–1 (18, 22).

Hoda Series

The Hoda series consists of well-drained soils underlain by weathered granodiorite. These soils are moderately sloping to very steep and are on mountainous uplands. Slopes are 5 to 75 percent. The vegetation is mostly ponderosa pine, incense cedar, black oak, madrone, sweet birch, manzanita, Scotch broom, and annual grasses and forbs. Elevation ranges from 2,000 to 4,000 feet. The annual rainfall is 40 to 55 inches, and the average annual air temperature is about 55° F. The frost-free season is 145 to 250 days.

In a representative profile the surface layer is about 12 inches of brown sandy loam. Reaction is medium acid. The subsoil is reddish-yellow loam and yellowish-red clay and sandy clay loam that extends to a depth of 63 inches or more. Reaction in the subsoil is strongly acid and very strongly acid.

Permeability is moderately slow in these soils. Effective rooting depth is 60 inches or more. Available water holding capacity is 7 to 11 inches.

The Hoda soils are used mostly for timber production. Some areas are used for limited grazing and irrigated pasture.

Representative profile of Hoda sandy loam, 9 to 15 percent slopes, 3 miles north-northeast of Nevada City, 150 feet west of Rock Creek Road, 800 feet west and 500 feet south of the east quarter corner of sec. 30, T. 17 N., R. 9 E.:

O1—3 inches to ½ inch, pine needles, oak leaves, twigs, and litter.

O2—½ inch to 0, partly decomposed litter.

A11—0 to 4 inches, brown (10YR 4/3) sandy loam, very dark grayish brown (10YR 3/2) when moist; strong, very fine and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

A12—4 to 12 inches, brown (7.5YR 5/4) sandy loam, dark brown (7.5YR 3/4) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and plastic; many very fine, fine, medium, and coarse roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

B1t—12 to 18 inches, reddish-yellow (7.5YR 6/6) loam, yellowish red (5YR 5/6) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, medium, and coarse roots; many very fine interstitial pores; few thin clay films as bridges between and coating mineral grains; strongly acid; clear, wavy boundary.

B21t—18 to 36 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) when moist; moderate, medium and coarse, angular blocky structure; hard, friable, sticky and plastic; common very fine and fine and few medium roots; common very fine tubular and interstitial pores; many thin clay films on ped faces and continuous moderately thick clay films lining pores; strongly acid; gradual, wavy boundary.

B22t—36 to 46 inches, yellowish-red (5YR 5/8) clay, yellowish red (5YR 4/8) when moist; moderate, medium and coarse, angular blocky structure; hard, friable, sticky and plastic; few very fine, fine, and medium roots; common very fine interstitial and few fine tubular pores; many moderately thick clay films on ped faces and lining pores; very strongly acid; clear, irregular boundary.

B31t—46 to 53 inches, yellowish-red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) when moist; weak, coarse, angular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine tubular and interstitial pores; common thin clay films on ped faces and lining pores; very strongly acid; abrupt, irregular boundary.

B32t—53 to 63 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 5/8) when moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; very few very fine roots; common very fine pores; few, moderately thick, red (2.5YR 4/8) clay films as bridges between mineral grains and lining pores, red (2.5YR 5/8) when moist; continuous moderately thick clay films lining old root channels; very strongly acid; many feet to unweathered rock.

The A horizon ranges from dark grayish brown or brown to dark brown. It is slightly acid to medium acid. As much as 30 percent of the soil material on the surface is cobblestones and as much as 10 percent in the profile is gravel or cobblestones in places. Depth to weathered granodiorite is 80 inches or more.

Hoda sandy loam, 5 to 9 percent slopes (HnB).—This soil is moderately sloping. Included in mapping are small areas of Chaix sandy loam, Josephine loam, Musik sandy loam, and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Hoda soil is used mostly for timber production. Some areas are used for limited grazing and irrigated pasture. Capability unit IIe–1 (22).

Hoda sandy loam, 9 to 15 percent slopes (HnC).—This strongly sloping soil is on mountainous uplands. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Chaix sandy loam, Josephine loam, Musick sandy loam, and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is moderate to high.

This Hoda soil is used mostly for timber production. Some areas are used for limited grazing and irrigated pasture. Capability unit IIIe–1 (22).

Hoda sandy loam, 15 to 50 percent slopes (HnE).—This moderately steep or steep soil is on mountainous uplands. Granitic rock outcroppings cover as much as 10 percent of the surface area, in exposures that are 100 to 300 feet apart.

Included with this soil in mapping are small areas of Chaix sandy loam and Musick sandy loam.

Runoff is medium to rapid on this soil. The hazard of erosion is high.

This Hoda soil is used mostly for timber production. Some areas are used for limited grazing. Capability unit VIe–1 (22).

Hoda cobbly sandy loam, 2 to 15 percent slopes, eroded (HoC2).—This soil has a profile similar to that described as representative for the series, but 2 to 4 inches of the surface layer has been lost. More than half of the acreage of this soil is eroded. Cobblestones and some stones cover about 15 to 30 percent of the surface of these eroded areas. In places rock outcroppings cover 2 to 10 percent of the surface area, in exposures that are 100 to 300 feet apart. These rocky areas are generally not as eroded as the areas that are cobbly or stony on the surface.

Included with this soil in mapping are small areas of Hoda sandy loam, Musick sandy loam, and Chaix sandy loam.

Runoff is medium on this soil. The hazard of erosion is slight to moderate.

This Hoda soil is used for timber production and limited grazing. Capability unit IVe–7 (22).

Hoda-Rock outcrop complex, 50 to 75 percent slopes (HpF).—The Hoda soil in this complex is very steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop that is granitic.

Included in mapping are small areas of Chaix sandy loam and Musick sandy loam.

Runoff is rapid. The hazard of erosion is very high.

This complex is used mostly for timber production. Capability unit VIIs–1 (22).

Horseshoe Series

The Horseshoe series consists of well-drained soils underlain by stratified sand and gravel. These soils are rolling to hilly and are on terraces of tertiary river gravel deposits. Slopes are 9 to 30 percent. The vegetation is conifer-hardwood forest and an understory of brush, forbs, and sparse grass. Elevation ranges from 1,500 to 4,000 feet. The annual rainfall is 40 to 60 inches, and the annual average air temperature is about 55° F. The frost-free season is 140 to 230 days.

In a representative profile the surface is littered with such forest debris as pine needles, oak leaves, and other vegetative material. The mineral surface layer is about 10 inches of reddish-brown and yellowish-red gravelly loam. Reaction is medium acid. The subsoil is about 40 inches of yellowish-red and red gravelly clay loam and light clay loam. Reaction in the subsoil is medium acid to very strongly acid. Strong-brown very gravelly loam is at a depth of about 50 inches. Reaction in this layer is very strongly acid. Stratified tertiary sand and gravel are at a depth of about 59 inches.

Permeability is moderate in these soils. Effective rooting depth is 48 to 60 inches or more. Available water holding capacity is 6 to 10 inches.

The Horseshoe soils are used for timber production, pasture, and grazing.

Representative profile of Horseshoe gravelly loam, 9 to 15 percent slopes, 1½ miles southwest of North Columbia on the southeast face of the hydraulic digging, 1,320 feet west and 300 feet north of the east quarter corner of sec. 7, T. 17 N., R. 9 E.:

O1—3 inches to 0, litter, duff, and twigs.

A1—0 to 2 inches, reddish-brown (5YR 4/4) gravelly loam, dark reddish brown (5YR 3/3) when moist; weak, fine and medium, granular structure; soft, very friable, nonsticky and nonplastic; common very fine and few fine roots; many very fine interstitial pores; medium acid; clear, smooth boundary.

A3—2 to 10 inches, yellowish-red (5YR 4/6) gravelly loam, dark reddish brown (2.5YR 3/4) when moist; weak, fine and medium, granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; many very fine interstitial pores; medium acid; gradual, smooth boundary.

B1t—10 to 17 inches, yellowish-red (5YR 4/8) gravelly light clay loam, dark red (2.5YR 3/6) when moist; weak, medium and coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and fine and common medium and coarse roots; many very fine interstitial pores; medium acid; gradual, smooth boundary.

B21t—17 to 32 inches, yellowish-red (5YR 4/8) gravelly clay loam, dark red (2.5YR 3/6) when moist; massive; slightly hard, friable, sticky and plastic; few very fine and fine and common medium and coarse roots; many very fine interstitial pores; few thin colloids bridging and staining mineral grains; many moderately thick clay films in pores; strongly acid; gradual, smooth boundary.

B22t—32 to 43 inches, red (2.5YR 4/8) gravelly clay loam, dark red (2.5YR 3/6) when moist; massive; slightly hard, firm, sticky and plastic; few very fine, fine, medium, and coarse roots; common very fine pores; common moderately thick colloids bridging and staining mineral grains; many moderately thick clay films in pores; very strongly acid; gradual, wavy boundary.

B3t—43 to 50 inches, yellowish-red (5YR 5/8) gravelly light clay loam, red (2.5YR 4/8) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; very few very fine and fine and few medium and coarse roots; few very fine pores; common moderately thick colloids bridging and staining mineral grains; many moderately thick clay films in pores; very strongly acid; gradual, wavy boundary.

IIC1—50 to 59 inches, strong-brown (7.5YR 5/8) very gravelly loam, strong brown (7.5YR 5/8) when moist; massive; slightly hard, firm, slightly sticky and slightly plastic; few medium and coarse roots; common moderately thick colloids bridging and staining mineral grains; many moderately thick clay films in pores; very strongly acid; gradual, wavy boundary.

IIIC2—59 to 69 inches, stratified sand and gravel.

The A horizon ranges from grayish-brown or pale-brown to reddish-brown or yellowish-red loam or gravelly loam. It is slightly acid to strongly acid. It is 5 to 20 percent gravel. The A horizon has granular or platy structure or is structureless (massive).

The B2t horizon ranges from red or brownish-yellow to yellowish-red clay loam or gravelly clay loam. Reaction is strongly acid or very strongly acid. This horizon is structureless (massive) or has blocky structure. It is 5 to 20 percent gravel.

Interbedded sand and gravel generally have the lowest reaction in the profile. Reaction generally increases with depth. Layers of gravel are more than 50 percent gravel. Content of gravel increases with depth. The gravel is generally rounded and is mostly quartz. The B2t horizon grades through a transitional IIC horizon to stratified, interbedded sand and gravel made up mostly of quartz. Depth to interbedded and stratified sand and gravel ranges from 48 to more than 60 inches.

Horseshoe gravelly loam, 9 to 15 percent slopes (HrC).—This rolling soil is on terraces of tertiary river channels that are made up of stratified sand and gravel. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Hoda sandy loam, Josephine loam, Musick sandy loam, Sites loam, Sites very stony loam, and areas of rock outcroppings. Also included are some undulating or gently rolling Horseshoe soils that have slopes of 2 to 9 percent.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Horseshoe soil is used mostly for timber production, grazing, and dry pasture. Some areas are used for irrigated pasture. Capability unit IVe–1 (22).

Horseshoe gravelly loam, 15 to 30 percent slopes (HrD).—This hilly soil is underlain by stratified tertiary sand and gravel.

Included with this soil in mapping are small areas of Hoda sandy loam, Josephine loam, Musick sandy loam, Sites loam, Sites very stony loam, and areas of rock outcroppings.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high.

This Horseshoe soil is used for timber production, grazing, and limited irrigated pasture. Capability unit IVe–1 (22).

Hotaw Series

The Hotaw series consists of well-drained soils underlain by weathered granodiorite. These moderately sloping to steep soils are on mountainous uplands. Slopes are 5 to 50 percent. The vegetation is mostly ponderosa pine, Douglas-fir, incense cedar, manzanita, ceanothus, black oak, other brush species, and forbs. Elevation ranges from 1,700 to 2,500 feet. The annual rainfall is 45 to 55 inches, and the average annual air temperature is 54° to 59° F. The frost-free season is 180 to 230 days.

In a representative profile (fig. 6) the surface layer is about 12 inches of pale-brown and light yellowish-brown sandy loam. Reaction is medium acid. The subsoil is 22 inches of light yellowish-brown heavy sandy loam and sandy clay loam. Reaction in the subsoil is medium acid and strongly acid. Weathered granodiorite is at a depth of about 34 inches.

Permeability is moderately slow in these soils Effective rooting depth is 24 to 40 inches. Available water holding capacity is 2.5 to 5 inches.

The Hotaw soils are used mostly for timber production. They are also used for grazing to a limited extent. Some small areas are used for irrigated pasture.

Representative profile of Hotaw sandy loam, from an area of Chaix-Hotaw complex, 30 to 50 percent slopes, and in an area where slope is 35 percent, 7 miles north-northwest of Grass Valley from a cut on the east side of a ranch road, 1,800 feet east and 1,600 feet north of the southwest corner of sec. 21, T. 17 N., R. 8 E.:

A11—0 to 4 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; weak, medium and coarse, granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine, medium, and coarse roots, common very fine tubular and interstitial pores; medium acid; clear, wavy boundary.

A12—4 to 12 inches, light yellowish-brown (10YR 6/4) sandy loam, brown (7.5YR 4/4) when moist; weak, medium and coarse, granular structure; slightly hard, friable, nonsticky and nonplastic; few very fine and fine and common medium and coarse roots; common very fine tubular and interstitial pores; medium acid; clear, wavy boundary.

B1—12 to 21 inches, light yellowish-brown (10YR 6/4) heavy sandy loam, brown (7.5YR 4/4) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine, fine, medium, and coarse roots; common very fine tubular and interstitial and few medium tubular pores; few thin colloid stains as bridges between sand grains and in pores; medium acid; clear, wavy boundary.

B21—21 to 34 inches, light yellowish-brown (10YR 6/4) sandy clay loam, strong brown (7.5YR 5/6) when moist; massive; hard, firm, sticky and slightly plastic; very few very fine and few medium and

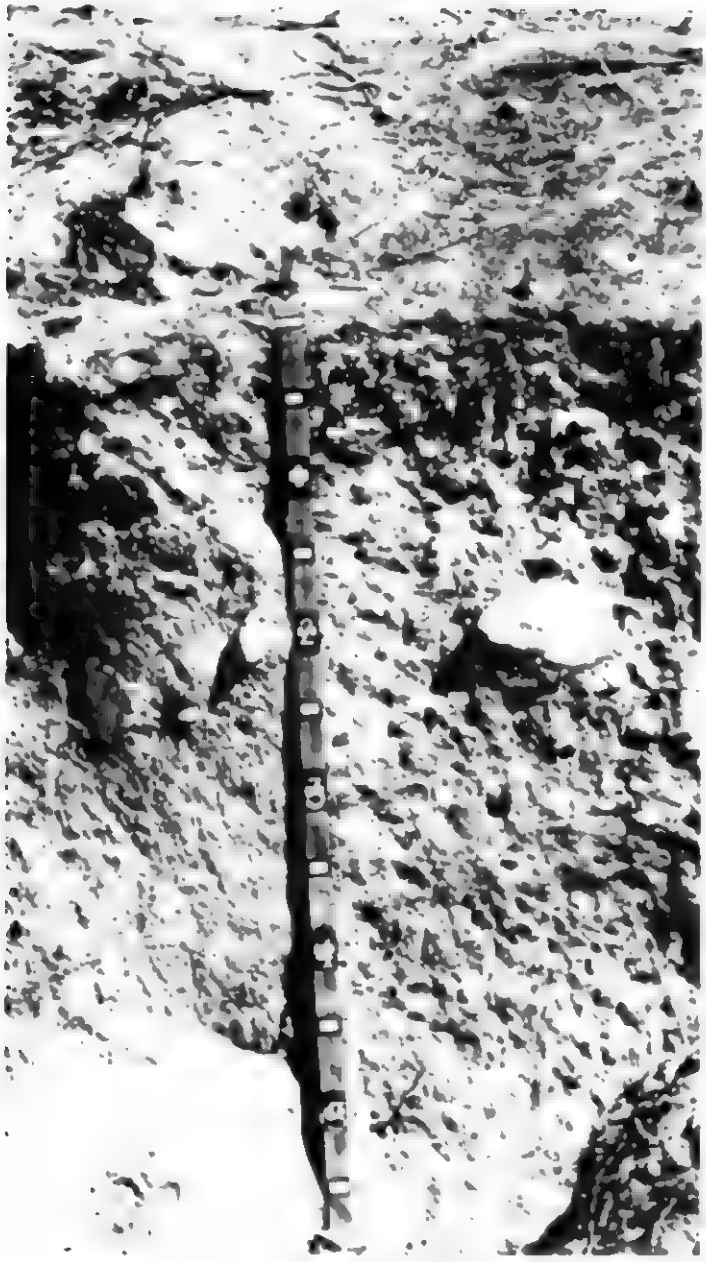

Figure 6.—Profile of Hotaw sandy loam.

coarse roots; common very fine tubular and interstitial and few medium tubular pores; common moderately thick clay films in pores; strongly acid; gradual, wavy boundary

C—34 inches, weathered granodiorite

The A horizon ranges from grayish-brown or pale brown to light yellowish brown coarse sandy loam or sandy loam. It is slightly acid or medium acid. The B2t horizon ranges from light yellowish brown to light brown coarse sandy clay loam or sandy clay loam. It is medium acid or strongly acid in reaction. It is structureless to massive or has blocky structure. The B2t horizon ranges from 9 to 17 inches in thickness. Stones and cobblestones make up as much as 5 percent of the surface in some areas. Depth to weathered granodiorite ranges from 24 to 40 inches.

Hotaw soils are only mapped in complex with Chaix soils.

Iron Mountain Series

The Iron Mountain series consists of somewhat excessively drained soils underlain by weathered andesitic conglomerate. These soils are undulating to steep and are on mountainous uplands. Slopes are 2 to 50 percent. The vegetation is mixed conifer and hardwood and an understory of brush and grasses and forbs. Elevation ranges from 2,500 to 4,600 feet. The annual rainfall is 45 to 55 inches; and the average annual air temperature is about 54° F. The frost-free season is 140 to 230 days.

In a representative profile the surface layer is about 11 inches of grayish-brown loam and cobbly loam. The substratum from 11 to 17 inches is grayish-brown cobbly loam. Reaction is slightly acid and medium acid. Slightly weathered andesitic conglomerate is at a depth of about 17 inches.

Permeability is moderately rapid in these soils. Effective rooting depth is 12 to 22 inches. Available water holding capacity is 1 to 2.5 inches.

The Iron Mountain soils are used mostly for watershed, as wildlife habitat, and for recreation. They are also used for timber production to a limited extent. Small open areas are used for grazing.

Representative profile of Iron Mountain cobbly loam, 2 to 50 percent slopes, 15 miles north-northeast of Grass Valley, in a cut on the northwest side of Snow Tent Road, ¼ mile east of the junction of Backbone Road and Snow Tent Road, 500 feet east and 1,100 feet south of the west quarter corner of sec. 30, T. 18 N., R. 10 E.:

O1—1 inch to 0, litter and duff

A11—0 to 3 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) when moist; strong, fine, granular structure; soft, very friable, slightly sticky and nonplastic; many very fine and fine and common medium roots; many very fine interstitial pores; slightly acid; abrupt, smooth boundary.

A12—3 to 11 inches, grayish-brown (10YR 5/2) cobbly loam, very dark brown (10YR 2/2) when moist; moderate, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; common very fine interstitial pores; 20 to 40 percent gravel and cobblestones; medium acid, clear, wavy boundary

C—11 to 17 inches, grayish-brown (2.5Y 5/2) cobbly loam, very dark grayish brown (10YR 3/2) when moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine, fine, medium, and coarse roots; common very fine interstitial pores; 15 to 50 percent gravel and cobblestones; medium acid, abrupt, irregular boundary.

R—17 inches, slightly weathered andesitic conglomerate; fractured in upper part.

The A horizon ranges from grayish brown to dark grayish brown and is sandy loam, gravelly sandy loam, cobbly sandy loam, loam, gravelly loam, or cobbly loam. Cobblestones generally make up 15 to 30 percent of the soil material in the profile, including the C horizon. Gravel makes up 10 to 25 percent of the soil material. A C2 horizon of well-weathered andesitic conglomerate is present in places. Depth to weathered andesitic conglomerate ranges from 12 to 22 inches but is variable within short distances.

Iron Mountain cobbly loam, 2 to 50 percent slopes (mE).—This undulating to steep soil on mountainous uplands is the only Iron Mountain soil in the area. It

has the profile described as representative for the series.

Included with this soil in mapping are small areas of Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, and McCarthy cobbly loam.

Runoff is medium to rapid on this soil, depending upon slope. The hazard of erosion is slight to high, also depending upon slope.

This Iron Mountain soil is used mostly for watershed, as wildlife habitat, and for recreation. It is also used for timber production to a limited extent. Small open areas are used for grazing. Capability unit VIIe–1 (22).

Josephine Series

The Josephine series consists of well-drained soils underlain by vertically tilted slate, shale, and contact metamorphic rock. These soils are gently rolling to very steep and are on mountainous uplands. Slopes are 5 to 75 percent. The vegetation is mostly mixed conifer and hardwood and shrubs. Elevation ranges from 2,000 to 4,500 feet. The annual rainfall is 45 to 55 inches, and the average annual air temperature is about 55° F. The frost-free season is 135 to 235 days.

In a representative profile the surface layer is 18 inches of reddish-brown loam and gravelly loam. Reaction is slightly acid and medium acid. The subsoil is 52 inches of reddish-yellow silty clay loam. Reaction in the subsoil is medium acid and strongly acid. Weathered slate and shale are at a depth of about 70 inches.

Permeability is moderate in these soils.

The Josephine soils are used for timber production, grazing, watershed, and as wildlife habitat. They are also used for pasture to a limited extent.

Representative profile of Josephine loam, 9 to 15 percent slopes, 14 miles north-northeast of Grass Valley, ¼ mile west of the intersection of Bear Trap Road and Tyler-Foote Crossing Road, 1,320 feet north and 1,000 feet west of the south quarter corner of sec. 21, T. 18 N., R. 9 E.:

O1 & O2—3 inches to 0, needles, litter, and duff.

A11—0 to 6 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) when moist; weak, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and coarse roots; many very fine and fine tubular pores; slightly acid; clear, smooth boundary.

A3—6 to 18 inches, reddish-brown (5YR 5/4) gravelly loam, yellowish red (5YR 4/6) when moist; weak, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many very fine tubular and interstitial and few fine and medium tubular pores; medium acid; gradual, slightly wavy boundary.

B21t—18 to 34 inches, reddish yellow (5YR 6/6) silty clay loam, yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and coarse roots; many very fine tubular and interstitial and common fine tubular pores; common thin clay films on ped faces and in pores; medium acid; gradual, smooth boundary.

B22t—34 to 51 inches, reddish-yellow (5YR 6/6) silty clay loam, yellowish red (5YR 4/8) when moist; strong, fine and medium, angular blocky structure; hard, firm, slightly sticky and plastic; few medium and coarse roots; many very fine tubular pores; many thin clay films on ped faces and in pores; strongly acid; gradual, smooth boundary.

B3—51 to 70 inches, reddish-yellow (5YR 6/8) silty clay loam, yellowish red (5YR 4/8) when moist; massive; hard, firm, slightly sticky and slightly plastic; few medium and coarse roots; few very fine tubular pores; many thin clay films in pores; strongly acid; gradual, smooth boundary.

C—70 inches, variegated strong-brown (7.5YR 5/6) and yellowish-red (5YR 5/8) weathered slate and shale; yellowish red (5YR 5/8) and red (2.5YR 4/6) when moist; strongly acid.

The A horizon ranges from brown or dark brown to reddish brown or yellowish brown. It is structureless (massive) or has weak granular structure. The A horizon is as much as 35 percent gravel in places.

The B2t horizon ranges from reddish yellow or strong brown to yellowish red or red in color, but in places it is brown. This horizon is clay loam, gravelly clay loam, or silty clay loam in texture.

Overlying the slightly weathered slate and shale in places is a C horizon. It is variegated strong brown, or yellowish red in color. In places the soil material throughout the profile is 20 to 25 percent cobblestones. Depth to the slate or shale ranges from 40 to 72 inches. The slate or shale is usually weathered, but in places changes abruptly to unweathered slate or shale.

Josephine loam, 9 to 15 percent slopes (JoC).—This rolling soil is on mountainous uplands. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Sites loam, Sites very stony loam, Cohasset cobbly loam, Cohasset loam, Mariposa gravelly loam, and areas of rock outcroppings. Also included are some areas that have slopes of 2 to 9 percent, some eroded areas, and some cobbly areas.

Runoff is medium on this soil. The hazard of erosion is moderate. Available water holding capacity is 8 to 10 inches. Effective rooting depth is 55 to 60 inches or more.

This Josephine soil is used for timber production. It is also used for grazing and irrigated pasture to a limited extent. Capability unit IIIe–1 (22).

Josephine loam, 15 to 30 percent slopes (JoD).—This hilly soil is on mountainous uplands.

Included with this soil in mapping are small areas of Sites loam, Sites very stony loam, Mariposa loam, Cohasset loam, and Cohasset cobbly loam. Also included are small eroded areas and some areas of Josephine cobbly loam.

Runoff is medium on this soil. The hazard of erosion is moderate. Available water holding capacity is 8 to 10 inches. Effective rooting depth is 55 to 60 inches or more.

This Josephine soil is used for timber production, limited grazing, and some pasture. Capability unit IVe–1 (22).

Josephine loam, 30 to 50 percent slopes (JoE).—This steep soil is on mountainous uplands.

Included with this soil in mapping are small areas of Cohasset loam, Cohasset cobbly loam, Sites loam, Sites very stony loam, Mariposa gravelly loam, and areas of rock outcroppings. Also included are eroded areas and some cobbly Josephine soils.

Runoff is medium to rapid on this soil. The hazard of erosion is high. Effective rooting depth is 55 to 60 inches or more. Available water holding capacity is 8 to 10 inches.

This Josephine soil is used for timber production and limited grazing. Capability unit VIe–1 (22).

Josephine cobbly loam, 5 to 30 percent slopes (JpD).—This gently rolling to hilly soil has a surface layer and subsoil of brown loam. Cobblestones make up 20 to 25 percent of the soil material throughout the profile.

Included with this soil in mapping are small areas of Cohasset loam, Cohasset cobbly loam, McCarthy cobbly loam, Josephine gravelly loam, and Mariposa gravelly loam. Also included are small eroded areas.

Runoff is medium on this soil. The hazard of erosion is slight to moderate. Effective rooting depth is 40 to 60 inches. Available water holding capacity is 5 to 9 inches.

This Josephine soil is used for timber production and limited grazing. Capability unit VIe–1 (22).

Josephine-Mariposa complex, 15 to 50 percent slopes, eroded (JrE2).—The soils in this complex are hilly to steep and are on mountainous uplands. About 55 percent of this complex is Josephine gravelly loam, and about 40 percent is Mariposa gravelly loam. The other 5 percent is included soils. Angular gravel fragments make up 10 to 35 percent of the soil material in the profile of both soils.

Included with these soils in mapping are small areas of Sites loam, Sites very stony loam, Cohasset loam, and Maymen loam, and areas of rock outcroppings.

Runoff is medium to rapid on these soils. The hazard of erosion is moderate to high. Joseph gravelly loam is 55 to 60 inches or more deep and has an available water holding capacity of 7 to 9 inches.

The soils in this complex are used mostly for timber production. Some areas are used for limited grazing. Capability unit VIe–1 (22).

Josephine-Mariposa complex, 50 to 75 percent slopes, eroded (JrF2).—The soils in this complex are very steep and are on mountainous uplands. Josephine and Mariposa soils each make up about 45 percent of the complex The other 10 percent is included soils. In both soils gravel is 10 to 35 percent of the soil material throughout the profile. Rock outcrops cover 10 to 25 percent of the surface area.

Included with this complex in mapping are small areas of Sites loam, Sites very stony loam, Iron Mountain cobbly loam, Horseshoe gravelly loam, and Cohasset cobbly loam.

Runoff is rapid on these soils. The hazard of erosion is high to very high. Josephine gravelly loam has an effective rooting depth of 55 to 60 inches or more and an available water holding capacity of 7 to 9 inches.

The soils in this complex are used for timber production and watershed, and as wildlife habitat. Capability unit VIIs–1 (22).

Josephine-Rock outcrop complex, 15 to 50 percent slopes (JsE).—This complex is hilly or steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 30 to 100 feet apart.

Included in mapping are small areas of Cohasset loam, Cohasset cobbly loam, Sites loam, Sites very stony loam, and Mariposa very gravelly loam. Also included are areas of some soils that have slopes of less than 15 percent or more than 50 percent.

Runoff is medium to rapid on the soils in this complex. The hazard of erosion is moderate to high. The Josephine gravelly loam has an available water holding capacity of 7 to 9 inches and an effective rooting depth of 55 to 60 inches or more.

This complex is used for timber production and limited grazing. The rock outcroppings interfere with logging operations in places. Capability unit VIs–1 (22).

Mariposa Series

The Mariposa series consists of well-drained soils underlain by slightly weathered slate and shale. These soils are undulating to very steep and are on mountainous uplands. Slopes are 2 to 75 percent. The vegetation is mostly ponderosa pine, sugar pine, Douglas-fir, black oak, live oak, manzanita, and forbs. Elevation ranges from 2,000 to 4,000 feet. The annual rainfall is 40 to 60 inches, and the average annual air temperature is about 56° F. The frost-free season is 140 to 235 days.

In a representative profile (fig. 7) the surface layer is about 3 inches of brown gravelly loam. Reaction is medium acid. The subsoil is about 17 inches of yellowish-brown gravelly heavy loam and reddish-yellow gravelly clay loam. Reaction in the subsoil is very strongly acid. Slightly weathered slate or shale is at a depth of about 20 inches.

Permeability is moderate in these soils. Effective rooting depth is 15 to 31 inches. Available water holding capacity is 2 to 4 inches.

The Mariposa soils are used for timber production, watershed, as wildlife habitat, and for limited grazing and pasture.

Representative profile of Mariposa gravelly loam, 2 to 30 percent slopes, 14 miles north-northeast of Grass Valley, 1,000 feet north-northeast of the southwest quarter corner of sec. 21, T. 18 N., R. 9 E.:

O1 & O2—1½ inches to 0, pine needles, duff, and partly decomposed litter.

A1—0 to 3 inches, brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine and common fine roots; many very fine and few fine tubular and interstitial pores; medium acid; clear, smooth boundary.

B1—3 to 10 inches, yellowish-brown (10YR 5/4) gravelly heavy loam, dark brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine, medium and coarse roots; many very fine tubular and interstitial pores; few thin clay films in pores; very strongly acid; clear, smooth boundary.

B2t—10 to 20 inches, reddish-yellow (7.5YR 6/6) gravelly clay loam, yellowish red (5YR 5/6) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; common very fine, fine, medium, and coarse roots;

Figure 7.—Profile of Mariposa gravelly loam.

Mariposa gravelly loam, 2 to 30 percent slopes (MoD).—This undulating to hilly soil is on mountainous uplands. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Josephine gravelly loam, Josephine loam, Sites loam, Sites very stony loam, Cohasset cobbly loam, McCarthy cobbly loam, Iron Mountain cobbly loam, and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Mariposa soil is used mostly for timber production. Some areas are used for limited grazing and pasture. Capability unit IVe–8 (22).

Mariposa-Maymen complex, 30 to 75 percent slopes, eroded (MeF2).—The soils in this complex are very steep and are along major drainageways in the western part of the Nevada County Area. About 55 percent of this complex is Mariposa gravelly loam, and about 10 percent is Maymen gravelly loam. The other 5 percent is included soils. Rock outcrops cover 2 to 25 percent of the surface area.

Included with these soils in mapping are small areas of Josephine loam and Josephine gravelly loam.

Runoff is rapid on these soils. The hazard of erosion is high to very high.

The soils in this complex are used as wildlife habitat and for watershed. They are also used for timber production to a limited extent. Capability unit VIIs–1 (22).

Mariposa-Rock outcrop complex, 2 to 50 percent slopes (MrE).—This complex is undulating to steep. About 2 to 25 percent of this complex is Rock outcrop.

Included in mapping are small areas of Josephine loam, Sites loam, Sites very stony loam, Cohasset loam, Cohasset cobbly loam, McCarthy cobbly loam, and Iron Mountain cobbly loam.

Runoff is medium to rapid. The hazard of erosion is moderate to high, depending upon slope.

This complex is used for timber production and limited grazing. Capability unit VIs–1 (22).

Maymen Series

The Maymen series consists of well-drained soils underlain by shattered and fractured slate. These soils are on mountainous uplands, generally along major drainageways. Slopes are 2 to 75 percent. The vegetation is mostly ponderosa pine, knobcone pine, incense cedar, manzanita, ceanothus, other shrub species, and forbs. Elevation ranges from 2,000 to 4,000 feet. The annual rainfall is 45 to 55 inches, and the average annual air temperature is 54° to 59° F. The frost-free season is 140 to 235 days.

In a representative profile the surface layer is about 5 inches of dark grayish-brown, brown, and grayish-brown gravelly light loam and loam. Reaction is slightly acid and medium acid. The subsoil is about 12 inches of grayish-brown gravelly loam. It is medium acid. Slightly shattered and fractured slate is at a depth of about 17 inches.

Permeability is moderate in these soils. Effective rooting depth is 12 to 18 inches. Available water holding capacity is 1 to 2 inches.

The Maymen soils are used as wildlife habitat and for watershed. They are also used for timber production and grazing to a limited extent.

Representative profile of Maymen gravelly loam, from an area of Maymen-Mariposa complex, 2 to 50 percent slopes, 17 miles northeast of Grass Valley, 25 feet southeast of the bridge over Bloody Run Creek on Backbone Road, 150 feet south and 850 feet west of the northeast corner of sec. 30, T. 18 N., R. 10 E.:

O1—1 inch to 0, litter.

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly light loam, very dark brown (10YR 2/2) when moist; strong, medium, granular structure; soft, very friable, nonsticky and nonplastic; many very fine roots; many very fine interstitial pores; 15 percent gravel; slightly acid; clear, wavy boundary.

A12—2 to 5 inches, brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine and few medium roots; common very fine interstitial pores; 15 percent gravel; medium acid; clear, irregular boundary.

B2—5 to 17 inches, grayish-brown (2.5Y 5/2) gravelly heavy loam, dark brown (10YR 3/3) when moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, sticky and slightly plastic; many very fine and fine and common medium and coarse roots; many very fine tubular and interstitial pores; few thin clay films on ped faces and in pores; 25 to 30 percent gravel; medium acid; abrupt, irregular boundary.

R—17 inches, nearly vertically tilted shattered and fractured slate.

The A horizon ranges from loam to gravelly loam. The B2 horizon ranges from grayish-brown to light brownish-gray heavy loam or gravelly heavy loam. It is slightly acid or medium acid. This horizon ranges from 2 to 16 inches in thickness within short distances. Gravel ranges from 5 to 35 percent of the soil material throughout the profile. A clear to abrupt boundary generally is present between the B2 and R horizons. The R horizon is shattered fractured slate and is commonly tilted nearly vertically, or it is slightly weathered, fractured basic rock. Depth to shattered and fractured slate or slightly weathered fractured basic rock ranges from about 12 to 18 inches and is variable within short distances in places.

Maymen-Mariposa complex, 2 to 50 percent slopes, eroded (MmE2).—The soils in this complex are undulating to steep and are along major drainageways in the eastern part of the Nevada County Area. About 55 percent of this complex is Maymen gravelly loam, and about 40 percent in Mariposa gravelly loam. The other 5 percent is included soils. About 25 to 35 percent of the acreage of this complex has had 25 to 50 percent of the surface layer removed by erosion. Rock outcrops cover 2 to 15 percent of the surface area. The Maymen soil in this complex has the profile described as representative for the Maymen series.

Included with these soils in mapping are small areas of Josephine gravelly loam, Josephine loam, McCarthy cobbly loam, and Iron Mountain cobbly loam.

Runoff is medium to rapid on these soils, and the hazard of erosion is moderate to high.

The soils in this complex are used mostly as wildlife habitat and for watershed. They also are used for timber production to a limited extent. Capability unit VIIe-1 (22).

McCarthy Series

The McCarthy series consists of well-drained soils underlain by weathered andesitic conglomerate. These soils are gently rolling to very steep and are on mountainous uplands and volcanic flows. Slopes are 5 to 75 percent. The vegetation is mostly ponderosa pine, Douglas-fir, incense cedar, sugar pine, black oak, manzanita, ceanothus, and bear clover. Elevation ranges from 2,800 to 4,600 feet. The annual rainfall is 48 to 55 inches, and the average annual air temperature is 48° to 51° F. The frost-free season is 140 to 200 days.

In a representative profile the surface generally is littered with such forest debris as pine needles, oak leaves, and other vegetative material. Similar material below the surface becomes more decomposed as depth increases. The mineral surface layer is about 10 inches of dark grayish-brown and brown cobbly loan. Reaction is slightly acid. The subsoil is about 21 inches of strong-brown and reddish-yellow very cobbly loam. Reaction in the subsoil is medium acid. Weathered andesitic conglomerate is at a depth of about 31 inches.

Effective rooting depth is 18 to 32 inches in these soils. Available water holding capacity is 2.5 to 4.5 inches.

The McCarthy soils are used for timber production and limited grazing.

Representative profile of McCarthy cobbly loam, 15 to 50 percent slopes, 17 miles north-northeast of Grass Valley on the north side of Backbone Road, 350 feet north of Bloody Run Creek, 1,000 feet north and 700 feet east of the southwest corner of sec. 21, T. 18 N., R. 10 E.:

O1 & O2—1 inch to 0, fresh pine needles, twigs, litter, duff, and partly decomposed organic matter.

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) when moist; strong, very fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; common very fine interstitial pores; slightly acid; abrupt, wavy boundary.

A12—2 to 10 inches, brown (10YR 4/3) cobbly loam, dark brown (7.5YR 3/2) when moist; moderate, fine, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many very fine and few medium and coarse roots; common very fine interstitial pores; 15 to 20 percent cobblestones; slightly acid; clear, wavy boundary.

B2—10 to 19 inches, strong-brown (7.5YR 5/6) very cobbly loam, dark reddish brown (5YR 3/4) when moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and common medium and coarse roots; common very fine interstitial pores; 40 to 45 percent cobblestones; medium acid; gradual, irregular boundary.

B3—19 to 31 inches, reddish-yellow (7.5YR 6/6) very cobbly loam, yellowish red (5YR 4/6) when moist; massive; soft, very friable, slightly sticky and slightly plastic; many very fine and fine and few medium and coarse roots; common very fine interstitial pores; 45 to 50 percent cobblestones; medium acid; abrupt, irregular boundary.

R 31 inches, andesitic conglomerate.

The A horizon ranges from brown or dark-brown to dark grayish-brown or grayish-brown loam, sandy loam, cobbly loam, or cobbly sandy loam. It is slightly acid to medium acid. It has granular or blocky structure or is structureless (massive). Cobblestones make up 10 to 25 percent of the A horizon.

The B horizon ranges from yellowish-brown or strong-brown to light yellowish-brown sandy loam to very cobbly loam. It has granular structure or is structureless (massive). Cobblestones make up 35 to 50 percent of this horizon, except in mapping unit MnE which lacks cobblestones. Some gravel is in the soil material of the profile. The underlying material generally is soft, weathered, rhyolitic tuff or andesitic conglomerate. Depth to weathered andesitic conglomerate ranges from 18 to 32 inches.

McCarthy sandy loam, 15 to 50 percent slopes (MnE).—This hilly to steep soil is generally on sides of sloping areas below andesitic ridges or "lava caps" and is adjacent to the Aiken soils, Cohasset soils, or McCarthy cobbly loam. Generally, this McCarthy soil has a cobblestone-free profile. This soil has a surface layer of grayish-brown or dark grayish-brown sandy loam or fine sandy loam. Reaction is slightly acid or medium acid. This layer has a granular structure. The subsoil is light yellowish-brown heavy sandy loam or very fine sandy loam. It is medium acid and is structureless (massive). The parent material consists of partly decomposed rhyolitic tuff, most of which breaks out in cobblestone-size fragments. This soil is high in vitric pryoclastic materials.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, Hoda sandy loam, Iron Mountain cobbly loam, and areas of rock outcrops.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high. Permeability is moderately rapid.

This McCarthy soil is used mostly for timber production. Some of the more open areas are used for limited grazing. Capability unit VIe–1 (22).

McCarthy cobbly loam, 5 to 15 percent slopes (MoC).—This gently rolling to rolling soil is on ridgetops and sides of andesitic flows. It is 15 to 50 percent cobblestones.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, and Iron Mountain cobbly loam.

Runoff is medium on this soil. The hazard of erosion is slight to moderate. Permeability is moderate.

This McCarthy soil is used for timber production and limited grazing. Capability unit VIe–1 (22).

McCarthy cobbly loam, 15 to 50 percent slopes (MoE).—This hilly and steep soil is on mountainous uplands, generally those underlain by andesitic conglomerate. The surface layer is 0 to 20 percent cobblestones, and the subsoil is 40 to 50 percent cobblestones. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of other McCarthy soils and of Iron Mountain cobbly loam, Cohasset cobbly loam, and Cohasset loam.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high, depending upon slope. Permeability is moderate.

This McCarthy soil is used mostly for timber production. Some areas are used for limited grazing. Capability unit VIe–1 (22).

Musick Series

The Musick series consists of well-drained soils underlain by weathered granodiorite. These soils are moderately sloping to steep and are on mountainous uplands. Slopes are 5 to 50 percent. The vegetation is mostly ponderosa pine, incense cedar, black oak, madrone, Scotch broom, poison oak, manzanita, ceanothus, and annual grasses and forbs. Elevation ranges from 2,000 to 3,500 feet. The annual rainfall is 44 to 55 inches, and the average annual air temperature is 52° to 56° F. The frost-free season is 145 to 250 days.

In a representative profile the surface layer is 25 inches of brown and reddish-brown sandy loam, light loam, and loam. Reaction is slightly acid and medium acid. The subsoil is about 73 inches of yellowish-red and red heavy clay loam and variegated reddish-yellow and yellow loam. Reaction in the subsoil is medium acid and slightly acid. Weathered granodiorite is at a depth of about 98 inches.

Permeability is moderately slow in the subsoil. Effective rooting depth is 40 to 60 inches or more. Available water holding capacity is 7 to 11 inches.

The Musick soils are used mostly for timber production and grazing. Some areas are used for irrigated pasture.

Representative profile of Musick sandy loam, 15 to 50 percent slopes, 7½ miles north-northwest of Nevada City on a road cut on the north side of a private dirt road, 800 feet west and 250 feet south of the east quarter corner of sec. 2, T. 17 N., R. 8 E.:

O1 & O2—4 inches to 0, litter and duff.

A11—0 to 4 inches, brown (7.5YR 5/4) sandy loam, dark reddish brown (5YR 3/4) when moist; strong, fine, medium, and coarse, granular structure; soft, friable, nonsticky and nonplastic; common very fine and fine roots; many very fine interstitial pores; slightly acid; clear, wavy boundary.

A12—4 to 19 inches, reddish-brown (5YR 5/4) sandy loam, dark reddish brown (5YR 3/4) when moist; moderate, coarse and very coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine and many medium roots; many very fine interstitial and common very fine tubular pores; few thin clay films in pores, as bridges, and as colloid stains on sand grains; medium acid; clear, wavy boundary.

A3—19 to 25 inches, reddish-brown (5YR 5/4) heavy sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine and many medium roots; common very fine interstitial and few fine tubular pores; few thin clay films in pores, as bridges, and as colloid stains on mineral grains; medium acid; clear, wavy boundary.

B1—25 to 40 inches, yellowish-red (5YR 5/6) clay loam, red (2.5YR 4/6) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; few very fine and many medium and coarse roots; few very fine tubular and interstitial pores; many moderately thick clay films on ped faces and in pores; medium acid; gradual, wavy boundary.

B21t—40 to 60 inches, red (2.5YR 5/6) heavy clay loam, red (2.5YR 4/6) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; few very fine and common medium and coarse roots; few very fine and fine tubular pores; many thick clay films on ped faces and in pores; medium acid; clear, wavy boundary.

B22t—60 to 69 inches, red (2.5YR 5/6) heavy clay loam, red (2.5YR 4/6) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; very few very fine and fine and common medium and coarse roots; few very fine and fine

tubular pores; many thick clay films on ped faces and in pores; medium acid; clear, wavy boundary.

B23t 69 to 80 inches, red (2.5YR 5/6) heavy clay loam, red (2.5YR 4/6) when moist; massive; hard, firm, sticky and plastic; very few fine and very fine and few medium and coarse roots; few very fine and fine tubular pores; common moderately thick clay films in pores and as bridges; medium acid; clear, wavy boundary.

B3—80 to 98 inches, variegated reddish-yellow (7.5YR 6/6) and yellow (10YR 7/6) loam, yellowish red (5YR 4/6) when moist; massive; slightly hard, firm, nonsticky and nonplastic; very few very fine and fine and few medium and coarse roots; few very fine and fine tubular pores; slightly acid; clear, wavy boundary.

C—98 inches, variegated very pale brown, yellow, and light yellowish-brown (10YR 7/4, 7/6, and 6/4) weathered granodiorite, strong brown (7.5YR 5/6) when moist; massive; slightly acid.

The A horizon ranges from brown or yellowish-brown to reddish-brown sandy loam or loam. The B2t horizon ranges from red or reddish yellow to yellow. It is medium acid or strongly acid. The B3 horizon is variegated very pale, brown, light yellowish brown, reddish yellow, or yellow. It is slightly acid or medium acid. A small amount of coarse gravel or cobblestones is in the soil material in places. Reaction generally decreases with depth. Hard rock is rarely encountered, except as outcrop or in very deep cuts. Depth to weathered granodiorite ranges from 40 to 80 inches or more.

Musick sandy loam, 5 to 15 percent slopes (MrC).—This soil is gently sloping to strongly sloping. Rock outcrops cover less than 2 percent to as much as 10 percent of the surface area.

Included with this soil in mapping are small areas of Hoda sandy loam, Chaix sandy loam, Josephine loam, and Sites loam. Also included are areas of Musick soils that have slopes of 2 to 9 percent.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Musick soil is used mostly for timber production. Some areas are used for limited grazing and irrigated pasture. Capability unit IIIe–1 (22).

Musick sandy loam, 15 to 50 percent slopes (MrE).—This moderately steep to step soil is on mountainous uplands. Rock outcrops cover as much as 10 percent of the surface area in places. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Hoda sandy loam, Chaix sandy loam, Josephine loam, and Sites loam.

Runoff is medium to rapid on this soil. The hazard of erosion is high.

This Musick soil is used mostly for timber production. Some areas are used for grazing. Capability unit VIe–1 (22).

Musick-Rock outcrop complex, 5 to 50 percent slopes (MsE).—The Musick soil in this complex is moderately sloping to steep. About 10 to 25 percent of this complex is Rock outcrop and areas that are very stony or extremely stony and that have .1 to 15 percent stones on the surface. About 25 percent of this complex has lost between 25 and 50 percent of the surface layer. Parts of this complex are moderately eroded, and here the stones are 2½ to 5 feet apart. Other areas are less than 40 inches deep.

Included in mapping are small areas of Musick sandy loam, Hoda sandy loam, and Chaix sandy loam.

Runoff is medium to rapid. The hazard of erosion is moderate to high. This complex is used mostly for timber production. Some areas are used for limited grazing. Capability unit VIs–1 (22).

Placer Diggings

Placer diggings (Pr) is a miscellaneous land type consisting of remnants of tertiary river deposits. These are hydraulically mined areas, placer-mined areas along stream channels, and areas of natural deposits along the stream channels. The hydraulically mined areas are in association with areas of Aiken, Cohasset, Josephine, Mariposa, Sites, Horseshoe, Hoda, Chaix, Iron Mountain, and Musick soils. The hydraulic mining has commonly formed steep clifflike sides that are as high as 100 feet. Slopes range from 2 to 75 percent.

In places this land type is 90 to 100 percent stones, cobblestones, or gravel. In 50 to 75 percent of the areas there is a mixture of stones, cobblestones, gravel, and enough soil material to support brush, some grasses, some trees along the stream channels, and poor to moderately good stands of ponderosa pine (fig. 8). In places bedrock is exposed along stream channels. This land type ranges from less than 6 inches to more than 10 feet in depth. Reaction generally is variable, but, in places in the hydraulically mined areas, it is strongly acid to very strongly acid. Seep or wet areas are present in places.

In areas of hydraulic or placer mining, the debris left by these operations commonly consists of irregular mounds. The areas along stream channels are commonly subject to inundation during periods of high water.

This land type is generally unsuitable for most agricultural uses, except for limited timber production or grazing in the areas that support stands of ponderosa pine and grass. Capability unit VIIs–1 (18, 22).

Rescue Series

The Rescue series consists of well-drained soils underlain by weathered basic rocks. These soils are gently rolling to hilly and are on mountainous uplands of the lower and middle part of foothills. Slopes are 5 to 30 percent. The vegetation is annual grasses and forbs, and blue oak, live oak, poison oak, digger pine, and scattered ponderosa pine. Elevation ranges from 500 to 2,000 feet. The annual rainfall is 28 to 45 inches, and the average annual temperature is about 60° F. The frost-free season is 225 to 260 days.

In a representative profile the surface layer is about 3 inches of brown loam. Reaction is slightly acid. The subsoil is about 30 inches of brown heavy loam and reddish-brown clay loam. Reaction in the subsol is medium acid. This horizon is underlain by brownish-yellow heavy loam that is slightly acid. Slightly weathered or fractured diabase is at a depth of about 50 inches.

Permeability is moderately slow. Effective rooting depth is 40 to 60 inches or more. Available water holding capacity is 6 to 10 inches.

Figure 8.—Sparse vegetation on area placer-mined about 1850.

The Rescue soils are used for winter and spring range. Some areas are used for irrigated pasture.

Representative profile of Rescue loam, from an area of Rescue-Rock outcrop complex, 5 to 30 percent slopes, 11 miles south of Grass Valley, 3,000 feet north of Magnolia Road, 950 feet east and 350 feet south of the northwest corner of sec. 23, T. 14 N., R. 8 E.:

O1—½ inch to 0, litter.

A1 0 to 3 inches, brown (7.5YR 5/4) loam, dark reddish brown (5YR 3/3) when moist; weak, medium and coarse, granular structure; slightly hard, friable, nonsticky and slightly plastic; many very fine roots; few very fine and fine tubular and many very fine and fine interstitial pores; slightly acid; clear, wavy boundary.

B1 3 to 9 inches, brown (7.5YR 5/4 heavy loam, dark reddish brown (5YR 3/4) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common very fine roots; few very fine and fine tubular and common very fine and fine interstitial pores; common thin clay films in pores and few thin clay films as bridges and as colloid stains on mineral grains; medium acid; clear, wavy boundary.

B21t—9 to 19 inches, reddish-brown (5YR 5/4) clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard, firm, sticky and plastic; common very fine, fine, and medium roots; few fine tubular and common very fine and fine interstitial pores; many moderately thick clay films in pores; medium acid; clear, wavy boundary.

B22t 19 to 33 inches, reddish-brown (5YR 5/4) clay loam, dark reddish brown (2.5YR 3/4) when moist; massive; hard, firm, sticky and plastic; few very fine and fine roots; few fine tubular and common fine interstitial pores; many moderately thick clay films in pores; medium acid; clear, wavy boundary.

C 33 to 50 inches, brownish-yellow (10YR 6/6) heavy loam that has reddish yellow (7.5YR 6/6) clay films, yellowish brown (10YR 5/6) and has dark-red (2.5YR 3/6) clay films when moist; massive; hard, firm, slightly sticky and plastic; many moderately thick clay films in fractures; slightly acid; gradual, wavy boundary.

R 50 inches, fractured and slightly weathered diabase.

The A horizon ranges from brown to dark brown. It is slightly acid or medium acid. It is structureless (massive) or has granular structure. The B2t horizon ranges from brown or reddish-brown to yellowish-red clay loam or sandy clay loam. A "stone line" is in the horizon immediately overlying the B2t horizon in places. The fragments in this line are the size of cobblestones and make up as much as 30 percent of the volume of this horizon in places. The

B2t horizon is underlain by a C horizon in places. Depth to hard bedrock is 40 to 60 inches or more.

Rescue-Rock outcrop complex, 5 to 30 percent slopes (RkD).—The Rescue soil in this complex is gently rolling to hilly and are on mountainous uplands of the middle part of foothills. About 10 to 25 percent of this complex is rock outcrop. The Rescue soil in this complex has the profile described as representative for the Rescue series.

Included in mapping are small areas of Auburn loam, Boomer loam, Sobrante loam, Argonaut loam, and soils that are similar to Rescue soils but that are less than 10 percent rock outcroppings. Also included are areas that have slopes of 30 to 75 percent.

Runoff is medium. The hazard of erosion is slight to moderate.

This complex is used mostly for annual range. Some of the less rocky areas are used for irrigated pasture. Capability unit VIs–1 (18).

Rock Land

Rock land (Rn) is a miscellaneous land type consisting of extremely rocky or stony basic, metabasic, metamorphosed, ultrabasic, and sedimentary rock material on hilly or steep mountainous areas. This land type extends throughout a wide area but is most commonly adjacent to major drainageways, such as the Bear River. It is undulating to extremely steep. Elevation ranges from 400 to 4,500 feet. Slopes range from 2 to 75 percent but are mostly more than 30 percent.

Rock outcrops cover 50 to 90 percent of the surface area. In places a very shallow mantle of soil is between the outcrops. This soil material is less than 10 inches deep. Also, small isolated areas of shallow to moderately deep soils are scattered among the rock outcrops in places. These are generally Auburn, Dubakella, Iron Mountain, Maymen, Mariposa, or Sobrante soils. Vegetation consists of such brush plants as chamise, scrub oak, manzanita, yerba santa, and poison oak and a sparse understory of annual grasses and forbes. In places scattered blue oak, live oak, and conifier are present in pockets of soil.

This land type is used for watershed and as wildlife habitat. Capability unit VIIIs–1 (18, 22).

Rock outcrop-Ahwahnee complex, 9 to 50 percent slopes (RoE).—About 40 to 65 percent of this complex is Ahwahnee sandy loam and about 25 to 50 percent is Rock outcrop. The other 10 percent is included soils. The Rock outcrop consists of large, rounded exposures of granitic rock that are about 15 to 30 feet apart.

Included in mapping are small areas of Auberry, Sierra, or Ahwahnee soils that have slopes of less than 9 percent and areas of Granitic rock land where slopes are more than 50 percent.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This complex is used for range and watershed and as wildlife habitat. Capability unit VIIs–1 (18).

Rock outcrop-Auburn complex, 2 to 30 percent slopes (RpD).—About 45 to 70 percent of this complex is Auburn loam, and about 25 to 50 percent is Rock outcrop. The other 5 percent is included soils. The Rock outcrop consists of angular or subangular exposures of basic or metabasic rock that are about 10 to 30 feet apart.

Included in mapping are small areas of Rescue, Sobrante, and Auburn soils and areas of Rock land where slopes are more than 50 percent.

Runoff is medium to rapid. The hazard of erosion is slight to moderate.

This complex is used for range and watershed and as wildlife habitat. Capability unit VIs–1 (18).

Rock outcrop-Dubakella complex, 5 to 50 percent slopes (RrE).—About 50 percent of this complex is Dubakella gravelly loam, and about 40 percent is Rock outcrop. The other 10 percent is included soils. Rock outcrop consists of semirounded exposures of ultrabasic rock. The Dubakella soil has the profile described as representative for the Dubakella series.

Included in mapping were small areas of a soil that is similar to the Dubakella soil but is not gravelly or cobbly and areas of Secca and Boomer soils.

Runoff is medium to rapid on the soil material of this complex. The hazard of erosion is moderate to high.

This complex is used as wildlife habitat, for watershed, and for limited range. Capability unit VIIs–1 (22).

Secca Series

The Secca series consists of moderately well drained soils underlain by metabasic or basic rock. These soils are undulating to steep and are on mountainous uplands. Slopes are 2 to 50 percent. The vegetation is mostly manzanita, ceanothus, blue oak, and grasses and forbs. Scattered digger pine and a few ponderosa pine are also present. Elevation ranges from 1,700 to 3,000 feet. The annual rainfall is 35 to 55 inches, and the average annual air temperature is 57° to 58° F. The frost-free season is 230 to 255 days.

In a representative profile the surface layer is 15 inches of brown and reddish-brown gravelly silt loam. Reaction is medium acid and slightly acid. The subsoil is about 30 inches of yellowish-red cobbly silty clay loam, strong-brown cobbly clay, and light yellowish-brown gravelly light clay. Reaction in the subsoil is slightly acid to mildly alkaline. Partly weathered basic rock is at a depth of about 45 inches.

Permeability is slow in these soils. Effective rooting depth is 40 to more than 60 inches, but some plant roots have difficulty penetrating the subsoil and extracting moisture from it. Available water holding capacity is 4 to 6 inches.

The Secca soils are used for watershed and limited grazing.

Representative profile of Secca gravelly silt loam, from an area of Secca-Rock outcrop complex, 2 to 50 percent slopes, 5 miles south-southwest of Grass Valley, 100 feet southeast of Wolf Creek Mountain Lookout Road, 1,300 feet east and 500 feet north of the west quarter corner of sec. 16, T. 15 N., R. 8 E.:

A1—0 to 6 inches, brown (7.5YR 5/4) gravelly silt loam, dark reddish brown (5YR 3/4) when moist;

strong, fine, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine and very few fine roots; common very fine tubular and interstitial pores; few cobblestones; about 40 percent gravel; medium acid; clear, wavy boundary.

A3—6 to 15 inches, reddish-brown (5YR 5/4) gravelly silt loam, dark reddish brown (5YR 3/4) when moist; moderate, medium and coarse, subangular blocky structure; slightly hard, friable, sticky and plastic; common very fine, medium, and coarse and very few fine roots; common very fine tubular and interstitial pores; few thin clay films on ped faces and in pores; few cobblestones; 25 percent gravel; slightly acid; clear, wavy boundary.

B1t—15 to 22 inches, yellowish-red (5YR 5/6) cobbly silty clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; very few fine and common very fine, medium, and coarse roots; many very fine tubular and interstitial and few fine interstitial pores; common thin clay films on ped faces and in pores; some cobblestones; 10 percent gravel; stone line in lower part; slightly acid; abrupt, wavy boundary.

B2t—22 to 36 inches, strong-brown (7.5YR 5/6) cobbly clay, brown (7.5YR 4/4) when moist; moderate, coarse prismatic structure; extremely hard, very firm, very sticky and very plastic; very few very fine and fine roots; very few very fine tubular and interstitial pores; continuous moderately thick clay films on ped faces; common pressure faces and few fine manganese shot; neutral; clear, wavy boundary.

B3t—36 to 45 inches, light yellowish-brown (2.5Y 6/4) gravelly light clay, yellowish brown (10YR 5/6) when moist; weak, coarse, angular blocky structure; very hard, firm, very sticky and plastic; very few very fine and fine roots; very few very fine tubular and interstitial pores; many moderately thick clay films on ped faces and in pores; mildly alkaline; gradual, wavy boundary.

C—45 inches, weathered metabasic rock.

The A horizon ranges from brown or reddish-brown to dark reddish-brown gravelly loam, gravelly silt loam, or cobbly loam. It generally has granular or subangular blocky structure, but has platy structure in a few places. This horizon is as much as 40 percent gravel in places.

Depth to the B2t horizon ranges from 9 to 22 inches. It ranges from brown or strong brown to reddish brown or yellowish red clay or cobbly clay. It is neutral or slightly acid in reaction and has blocky or prismatic structure. A "stone line" of hard, broken rock fragments is commonly between the B1t and B2t horizons. These rock fragments make up 25 percent of this layer in places. The B2t horizon is commonly underlain by a B3t horizon that is pale-brown or light yellowish-brown loam, clay loam, silty clay loam, or light clay. This horizon is gravelly in places.

A gravel pavement is on the surface of some of these soils. These are the more eroded areas and are away from areas that are covered by manzanita brush. As much as 60 percent of the surface has a gravel pavement, but only 25 percent of the surface is covered by a pavement in areas that are covered by manzanita brush. Secca soils are 15 to 35 percent cobblestones, 1 to 10 percent stones, and about 10 to 40 percent gravel in places. The more rocky and more cobbly conditions generally do not occur at the same place. Reaction generally increases with depth. Depth to underlying bedrock ranges from 40 to 60 inches or more.

Secca-Rock outcrop complex, 2 to 50 percent slopes (ScE).—The Secca soil in this complex is undulating to steep and is on mountainous uplands (fig. 9). About 10 to 40 percent of this complex is Rock outcrop. The Secca soil in this complex has the profile described as representative for the Secca series.

Included in mapping are small areas of Boomer loam, Sites loam, Sites very stony loam, and Rescue loam.

Runoff is medium to rapid, depending upon slope. The hazard of erosion is slight to high.

This complex is used for watershed and limited grazing. Capability unit VIIs–1 (22).

Shenandoah Series

The Shenandoah series consists of somewhat poorly drained soils underlain by weathered granitic rock. These soils are undulating to rolling. Slopes are 2 to 15 percent and are generally concave. The vegetation is mostly oak, live oak, digger pine, wiregrass, and annual grasses and sedges. Elevation ranges from 600 to 1,800 feet. The annual rainfall is 30 to 40 inches, and the average annual air temperature is about 61° F. The frost-free season is 240 to 260 days.

In a representative profile the surface layer is about 18 inches of brown and pale-brown sandy loam. Reaction is medium acid. The subsoil is about 9 inches of light brownish-gray clay. Reaction in the subsoil is slightly acid. The substratum is pale-brown coarse sandy loam, and it is neutral in reaction. Weathered granodiorite is at a depth of about 36 inches.

Permeability is very slow in the subsoil. Effective rooting depth is 27 to 40 inches. Available water holding capacity is 3 to 5 inches.

The Shenandoah soils are used for annual range, improved dry pasture, and irrigated pasture.

Representative profile of Shenandoah sandy loam, 2 to 15 percent slopes, 10 miles south-southwest of Grass Valley, 1,900 feet east and 300 feet south of the north quarter corner of sec. 35, T. 15 N., R. 7 E.:

A11—0 to 3 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 3/3) and dark grayish brown (10YR 4/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine tubular and interstitial pores; medium acid; abrupt, smooth boundary.

A12—3 to 9 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine and fine tubular and interstitial pores; medium acid; clear, smooth boundary.

A3—9 to 18 inches, pale-brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) when moist; massive; hard, firm, nonsticky and nonplastic; very few very fine roots; many very fine tubular and interstitial pores; medium acid; abrupt, wavy boundary.

B2t—18 to 27 inches, light brownish-gray (2.5YR 6/2) clay that has common, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles, grayish brown (2.5YR 5/2), and has common, fine and medium, yellowish-brown (10YR 5/6) mottles when moist; strong, coarse, prismatic structure; very hard, extremely firm, sticky and plastic; very few very fine roots; few very fine and fine tubular pores; continuous thick clay films in pores and on ped faces, slightly acid; abrupt, wavy boundary.

C1—27 to 36 inches, pale-brown (10YR 6/3) coarse sandy loam that has common, medium, distinct, yellowish-brown (10YR 5/8) mottles, dark yellowish brown (10YR 4/4) and has common, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles when moist; massive; hard, friable, nonsticky and nonplastic; very few very fine roots; very few

Figure 9.—Area of Secca-Rock outcrop complex, 2 to 50 percent slopes.

very fine tubular pores; few thin clay films as bridges and colloid stains; neutral; gradual, smooth boundary.

C2—36 inches, weathered granodiorite.

The A1 horizon is about 3 to 9 inches thick and ranges from brown or pale brown to light brownish gray in color. It is slightly acid or medium acid. The B2t horizon is about 8 to 18 inches thick and ranges from grayish brown or light brownish gray to light yellowish brown in color. It is slightly acid or medium acid. The C1 horizon is pale-brown or light brownish-gray coarse sandy loam to loam. It is neutral or slightly acid. A few coarse pebbles or cobblestones are present in places. These soils have mottles within a depth of 30 inches. Depth to weathered granitic bedrock ranges from 27 to 40 inches.

Shenandoah sandy loam, 2 to 15 percent slopes (SdC).—This soil is undulating to rolling, and slopes are commonly concave. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Ahwahnee sandy loam, Auberry sandy loam, Sierra sandy loam, and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is slight to moderate.

This Shenandoah soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IIIw–3 (18).

Sierra Series

The Sierra series consists of well-drained soils underlain by weathered granodiorite. These soils are undulating to steep and are on the lower and middle parts of foothills. Slopes are 2 to 50 percent. The vegetation is mostly annual grasses and forbs, and blue oak, live oak, manzanita, and scattered or open stands of ponderosa pine. Elevation ranges from 400 to 2,000 feet. The annual rainfall is 28 to 38 inches, and the average annual air temperature is about 60° F. The frost-free season is 240 to 260 days.

In a representative profile the surface layer is 9 inches of brown or dark-brown sandy loam. Reaction is slightly acid. The subsoil is about 36 inches of reddish-brown heavy sandy loam and yellowish-red and reddish-yellow sandy clay loam. Reaction in the subsoil is slightly acid and medium acid. Coarse-grained, well-weathered granodiorite is at a depth of about 45 inches.

Permeability is moderately slow in these soils. Effective rooting depth is 42 to 60 inches or more. Available water holding capacity is 6 to 9 inches.

The Sierra soils are used for annual range, improved dry pasture, and irrigated pasture.

Representative profile of Sierra sandy loam, 9 to 15 percent slopes, 10 miles southwest of Grass Valley, 1 mile west of McCourtney Road, 1,320 feet north and 500 feet east of the west quarter corner of sec. 35, T. 15 N., R. 7 E.:

A11—0 to 2 inches, dark-brown (7.5YR 4/2) sandy loam, dark brown (7.5YR 3/2) when moist; moderate, fine and medium, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine interstitial pores; slightly acid; clear, smooth boundary.

A12—2 to 9 inches, brown (7.5YR 5/4) sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular and interstitial and many fine and medium tubular pores; slightly acid; clear, smooth boundary.

B1—9 to 16 inches, reddish-brown (5YR 4/4) heavy sandy loam, dark reddish brown (5YR 3/4) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine and medium tubular pores; few thin clay films as bridges between mineral grains and as colloid stains on mineral grains; slightly acid; clear, smooth boundary.

B21t—16 to 24 inches, yellowish-red (5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; weak, medium and coarse, subangular blocky structure; hard, firm, sticky and plastic; very few very fine roots; common very fine tubular and interstitial and common fine and medium tubular pores; many moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; slightly acid; clear, smooth boundary.

B22t—24 to 35 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; moderate, medium and coarse, subangular blocky structure; hard, firm, sticky and plastic; very few very fine roots; common very fine tubular and interstitial and common fine and medium tubular pores; many moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; medium acid; clear, smooth boundary.

B3—35 to 45 inches, reddish-yellow (7.5YR 6/6) sandy clay loam that has red (2.5YR 4/6) clay films, yellowish red (5YR 4/6) when moist; moderate, medium and coarse, subangular blocky structure; hard, firm, sticky and plastic; common very fine interstitial pores; many moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; medium acid; gradual, wavy boundary.

C—45 inches, light yellowish-brown (10YR 6/4) well-weathered granodiorite that crushes to sandy loam, yellowish red (5YR 4/8) when moist; massive; medium acid.

The A horizon ranges from brown to dark-brown sandy loam or loam. It has granular structure or is structureless (massive). This horizon is 8 to 10 inches thick.

The B2t horizon ranges from clay loam to sandy clay loam. It is structureless (massive) or has subangular blocky structure. The B3 horizon is dark yellowish-brown, reddish-yellow, or yellowish-red clay loam or sandy clay loam. It is slightly acid or medium acid. It is structureless (massive) or has subangular blocky structure.

The C horizon is light yellowish-brown or pale-brown, deeply weathered granodiorite. Mica and light- and dark-colored mineral grains are commonly apparent in the B2t, B3, and C horizons.

A few coarse pebbles are in Sierra soils. A "stone line" of cobblestone size fragments commonly is at a depth of 13 to 18 inches. Depth to weathered granodiorite ranges from 42 to more than 60 inches.

Sierra sandy loam, 2 to 9 percent slopes (SfB).—This undulating and gently rolling soil is on mountainous uplands of the lower and middle parts of foothills. Rock outcrops cover as much as 10 percent of the surface area in places.

Included with this soil in mapping are small areas of Ahwahnee sandy loam and Auberry sandy loam.

Runoff is medium on this soil. The hazard of erosion is slight to moderate.

This Sierra soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IIIe–1 (18).

Sierra sandy loam, 9 to 15 percent slopes (SfC).—This rolling soil is on mountainous uplands. Rock outcrops cover as much as 10 percent of the surface area in places. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Ahwahnee sandy loam, Auberry sandy loam, and Shenandoah sandy loam.

Runoff is medium to rapid on this soil. The hazard of erosion is slight to high.

This Sierra soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IVe–1 (18).

Sierra sandy loam, 15 to 30 percent slopes (SfD).—This hilly soil is on mountainous uplands of the middle and lower parts of foothills. Rock outcrops cover as much as 10 percent of the surface area in places.

Included with this soil in mapping are small areas of Ahwahnee sandy loam and Auberry sandy loam.

Runoff is medium to rapid on this soil. The hazard of erosion is high.

This Sierra soil is used for annual range and improved dry pasture. Capability unit VIe–1 (18).

Sierra-Rock outcrop complex, 15 to 30 percent slopes (SkD).—The Sierra soil in this complex is hilly and is on the lower and middle parts of foothills. About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 30 to 100 feet apart. A few coarse pebbles and cobblestone-size fragments are in the profile in places.

Included in mapping are small areas of Ahwahnee sandy loam, Sierra sandy loam, and Auberry sandy loam.

Runoff is medium to rapid. The hazard of erosion is high.

This complex is used for annual range. Capability unit VIs–1 (18).

Sierra-Rock outcrop complex, 30 to 50 percent slopes (SkE).—The Sierra soil of this complex is steep and is on mountainous uplands in the lower and middle parts of foothills. About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 30 to 100 feet apart. A few cobblestone-size fragments are in the profile in places.

Included in mapping are small areas of Ahwahnee sandy loam, Sierra sandy loam, Auberry sandy loam, and Shenandoah sandy loam.

Runoff is rapid. The hazard of erosion is very high. This complex is used for annual range. Capability unit VIIs–1 (18).

Sites Series

The Sites series consists of well-drained soils underlain by tilted metasedimentary and metabasic rock. These soils are undulating to steep. Slopes are 2 to 50 percent. The vegetation is mostly mixed conifer and hardwood and shrubs. Elevation ranges from 2,000 to 4,000 feet. The annual rainfall is 40 to 60 inches, and the average annual air temperature is about 55° F. The frost-free season is 140 to 240 days.

In a representative profile the surface layer is about 12 inches of brown and yellowish-red heavy loam. Reaction is slightly acid or medium acid. The subsoil is about 56 inches of yellowish-red clay loam and red clay, and light clay. Reaction in the subsoil is medium acid and strongly acid. The substratum is yellowish-red clay loam. Reaction in this layer is strongly acid. Weathered metasedimentary and basic rock is at a depth of about 78 inches.

Permeability is moderately slow in the subsoil. Effective rooting depth is 40 to 60 inches or more. Available water holding capacity is 6 to 10 inches.

The Sites soils are used for timber production, grazing, pasture, and deciduous orchards.

Representative profile of Sites loam, 15 to 30 percent slopes, 10 miles north-northeast of Grass Valley, 1½ miles north of Edwards Crossing, 1,320 feet west and 150 feet south of the east quarter corner of sec. 8, T. 17 N., R. 9 E.:

O1 & O2—2 inches to 0, pine needles, duff, and partly decomposed litter.

A11—0 to 3 inches, brown (7.5YR 5/4) heavy loam, dark reddish brown (5YR 3/4) when moist; moderate, thick and very thick, platy structure; hard, friable, sticky and plastic; common very fine and fine roots; common to few very fine tubular and interstitial pores; slightly acid; clear, wavy boundary.

A12—3 to 6 inches, yellowish-red (5YR 5/6) heavy loam, yellowish red (5YR 4/6) when moist; moderate, medium and coarse, granular structure; hard, friable, sticky and plastic; few very fine and fine and common medium roots; common very fine tubular and interstitial pores; medium acid; clear, wavy boundary.

A3—6 to 12 inches, yellowish-red (5YR 5/6) heavy loam, yellowish red (5YR 4/6) when moist; weak, medium and coarse, granular structure; slightly hard, friable, sticky and plastic; few very fine, fine, and coarse and common medium roots; common very fine tubular and interstitial pores; few thin colloid stains on mineral grains and bridging mineral grains; medium acid; clear, wavy boundary.

B1—12 to 23 inches, yellowish-red (5YR 5/6) clay loam, red (2.5YR 4/6) when moist; moderate, coarse and very coarse, subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and coarse and common medium roots; common very fine tubular and interstitial pores; many moderately thick clay films on ped faces, in pores, and as bridges between mineral grains; medium acid; clear, wavy boundary.

B21t—23 to 37 inches, red (2.5YR 4/8) clay, red (10R 4/6) when moist; strong, coarse and very coarse, angular blocky structure; very hard, firm, very sticky and very plastic; very few very fine and fine and few medium roots; common very fine tubular pores; many thick clay films on ped faces and in pores; medium acid; gradual wavy boundary.

B22t—37 to 56 inches, red (2.5YR 5/8) light clay, red (10R 4/6 matrix, 10R 4/8 clay films) when moist; strong, coarse and very coarse, angular blocky structure; hard, firm, very sticky and very plastic; very few very fine and fine and few medium roots; common very fine tubular pores; many thick clay films on ped faces and in pores; strongly acid; gradual, wavy boundary.

B3t—56 to 68 inches, red (2.5YR 5/8) light clay, red (10R 4/8) when moist; weak, coarse and very coarse, subangular blocky structure; hard, firm, very sticky and very plastic; few very fine tubular and interstitial pores; common moderately thick clay films on ped faces and in pores; strongly acid; gradual, wavy boundary.

C—68 to 78 inches, yellowish-red (5YR 5/8) clay loam, red (2.5Y 4/8) when moist; weak, coarse and very coarse, subangular blocky structure; hard, firm, sticky and plastic; few moderately thick clay films on ped faces, as bridges between mineral grains, and as colloid stains on mineral grains; strongly acid; clear, smooth boundary.

R—78 inches, weathered metasedimentary rock.

The A horizon ranges from brown or reddish-brown to yellowish-red loam, gravelly loam, or heavy loam. It generally has blocky or granular structure, but, in places, has platy structure or is structureless (massive).

The B2t horizon ranges from red or dark-red to yellowish-red heavy clay loam, heavy silty clay loam, or clay. It is medium acid, strongly acid, or very strongly acid. It has blocky structure or is structureless (massive).

A red or yellowish-red C horizon generally is present.

Gravel makes up as much as 15 percent of the soil material in the profile of Sites soils in places. Reaction decreases with depth. In places a few iron or manganese concretions are in the soil material. Also some areas are 10 to 25 percent cobblestones and as much as 3 percent stones. Depth to underlying metasedimentary and metabasic rock ranges from 40 to more than 70 inches. The underlying metasedimentary rock generally is weathered, but changes abruptly to unweathered sedimentary rock or basic rock in places.

Sites loam, 2 to 9 percent slopes (SlB).—This soil is undulating and gently rolling.

Included with this soil in mapping are small areas of Sites very stony loam, Mariposa loam, Josephine gravelly loam, Josephine loam, Cohasset loam, Cohasset cobbly loam, Aiken loam, Aiken cobbly loam, Boomer loam, and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is slight.

This Sites soil is used for timber production, grazing, irrigated pasture, and deciduous orchards. Capability unit IIe–1 (22).

Sites loam, 9 to 15 percent slopes (SlC).—This rolling soil is on mountainous uplands.

Included with this soil in mapping are small areas of Sites very stony loam, Josephine gravelly loam, Josephine loam, Boomer loam, Mariposa gravelly loam, Aiken loam, Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, and areas of rock outcroppings. Also included are areas of this soil that have lost 25 to 50 percent of the original surface layer.

Runoff is medium on this soil. The hazard of erosion is slight to moderate.

This Sites soil is used for timber production, grazing, irrigated pasture, and deciduous orchards. Capability unit IIIe–1 (22).

Sites loam, 15 to 30 percent slopes (SlD).—This hilly soil is on mountainous uplands. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Sites very stony loam, Josephine gravelly loam, Josephine loam, Cohasset loam, Cohasset cobbly loam, Mariposa gravelly loam, Aiken loam, Aiken cobbly loam, and areas of rock outcroppings.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Sites soil is used for timber production, irrigated pasture, and deciduous orchards. Capability unit IVe–1 (22).

Sites very stony loam, 2 to 15 percent slopes (SmC).—This undulating to rolling soil is on mountainous uplands. It is .1 to 3 percent stones or 10 to 25 percent cobblestones. Rock outcrops cover as much as 3 percent of the surface area, and the soil material in the profile is .1 to 3 percent stones or 10 to 25 percent cobblestones.

Included with this soil in mapping are small areas of Sites loam, Boomer loam, Cohasset loam, Cohasset cobbly loam, Mariposa loam, and Josephine loam. Also included are cobbly areas that have lost 25 to 75 percent of the original surface layer, and areas that are essentially nonstony.

Runoff is medium on this soil. The hazard of erosion is slight to moderate, depending upon slope.

This Sites soil is used for timber production, irrigated pasture, grazing, and deciduous orchards. Capability unit IVs–7 (22).

Sites very stony loam, 15 to 50 percent slopes (SmE).—This hilly to steep soil is on mountainous uplands. It is as much as 3 percent stones or 10 to 25 percent cobblestones. Rock outcrops cover as much as 3 percent of the surface area in places.

Included with this soil in mapping are small areas of Aiken loam, Aiken cobbly loam, Cohasset loam, Cohasset cobbly loam, Josephine loam, Mariposa loam, Boomer loam, and Sites loam. Also included are some areas that are essentially nonstony. About 50 percent of this soil has lost 25 to 75 percent of the original surface layer. These areas are cobbly.

Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high, depending upon slope.

This Sites soil is used for timber production, grazing, irrigated pasture, and deciduous orchards. The more gently sloping soils are used for irrigated pasture and deciduous orchards. The stones and cobblestones interfere with cultivation. Capability unit VIs–1 (22).

Sobrante Series

The Sobrante series consists of well-drained soils underlain by slightly weathered metabasic rock. These soils are undulating to steep and are on the lower and middle parts of foothills. Slopes are 2 to 50 percent. The vegetation is mostly annual grasses and forbs, and blue oak, live oak, poison oak, and other brush species. Elevation ranges from 500 to 2,000 feet. The annual rainfall is 28 to 45 inches, and the average annual air temperature is about 60° F. The frost-free season is 240 to 260 days.

In a representative profile the surface layer is about 9 inches of reddish-brown loam. Reaction is slightly acid or medium acid. The subsoil is 18 inches of reddish-brown heavy loam and light clay loam. Reaction in the subsoil is slightly acid. The subtratum of weathered diabase is at a depth of about 27 to 37 inches. Slightly weathered diabase is at 37 inches.

Permeability is moderate in these soils. Effective rooting depth is 24 to 36 inches. Available water holding capacity is 3.5 to 6 inches.

The Sobrante soils are used for annual range, irrigated pasture, and dry pasture.

Representative profile of Sobrante loam, from an area of 13 percent slopes, 13 miles south-southwest of Grass Valley on the east side of Garden Bar Road, 1,100 feet west and 1,050 feet south of the north quarter corner of sec. 23, T. 14 N., R. 7 E.:

A11—0 to 3 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; strong, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; many very fine interstitial pores; slightly acid; abrupt, wavy boundary.

A12—3 to 9 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; common very fine interstitial pores; medium acid; clear, wavy boundary.

B1—9 to 19 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/4) when moist; massive; hard, firm, sticky and slightly plastic; few very fine and very few fine roots; common very fine and fine tubular and interstitial pores; common thin clay films in pores, as bridges, and as colloid stains on mineral grains; slightly acid; clear, wavy boundary.

B2t—19 to 27 inches, reddish-brown (5YR 4/4) light clay loam, dark reddish brown (5YR 3/4) when moist; massive; hard, firm, sticky and plastic; very few very fine, fine, and medium roots; common very fine and fine tubular and interstitial pores; many thin clay films in pores, as bridges, and as colloid stains on mineral grains; slightly acid; clear, wavy boundary.

C—27 to 37 inches, brown (7.5YR 5/4) weathered disabase that has red (2.5YR 4/6) clay films in fracture planes; brown or dark brown (7.5YR 4/4) and has dark-red (2.5YR 3/6) clay films when moist; clear, wavy boundary.

R—37 inches, slightly weathered diabase.

The A horizon ranges from brown or strong-brown to reddish-brown loam or gravelly loam. The B2t horizon ranges from reddish-brown or yellowish-red to red light clay loam, clay loam, or gravelly clay loam. It is slightly acid or medium acid in reaction. It is structureless (massive) or has blocky structure. The C horizon is yellowish-brown, brown, or reddish-yellow diabase or metabasic rock that weathers to clay loam. It is structureless (massive). A lithic contact commonly is between depths of 20 and 40 inches. In places the soil material is 15 to 30 percent gravel. Depth to weathered or fractured bedrock ranges from 24 to 37 inches, and depth is variable within short distances.

Sobrante loam, 2 to 15 percent slopes (SoC).—This undulating to rolling soil is on mountainous uplands of the middle and lower parts of foothills. Rock outcrops cover less than 10 percent of the surface area.

Included with this soil in mapping are small areas of Auburn loam, Argonaut gravelly loam, and Rescue loam.

Runoff is medium on this soil. The hazard of erosion is slight to moderate.

This Sobrante soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IIIe–8 (18).

Sobrante loam, 15 to 30 percent slopes (SoD).—This hilly soil is on the middle and lower parts of foothills. Rock outcrops cover less than 10 percent of the surface area.

Included with this soil in mapping are small areas of Auburn loam, Argonaut gravelly loam, Rescue loam, and Boomer loam.

Runoff is medium on this soil. The hazard of erosion is moderate.

This Sobrante soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IVe–8 (18).

Sobrante-Rock outcrop complex, 2 to 30 percent slopes (SrD).—The Sobrante soil in this complex is undulating to hilly and is on mountainous uplands. It has the profile described as representative for the Sobrante series. About 10 to 25 percent of this complex is Rock outcrop.

Included in mapping are small areas of Auburn loam, Rescue loam, and Argonaut gravelly loam.

Runoff is medium. The hazard of erosion is slight to moderate.

This complex is used for annual range. Capability unit VIs–1 (18).

Sobrante-Rock outcrop complex, 30 to 50 percent slopes (SrE).—The Sobrante soil in this complex is steep and is on mountainous uplands in the lower and middle parts of foothills, generally along creek channels and drainageways. About 10 to 25 percent of this complex is Rock outcrop.

Included in mapping are small areas of Auburn loam, Rescue loam, and Argonaut gravelly loam.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This complex is used for annual range. Capability unit VIs–1 (18).

Tailings

Tailings (Ta) is a miscellaneous land type consisting of hard-rock mine dumps and hydraulic diggings that are remnants of old tertiary river gravel deposits once containing gold. Areas that have been hydraulically mined and washed with extremely powerful streams of water are very deep and have steep clifflike sides as high as 120 feet in places. Stones, cobblestones, and gravel cover 90 to 100 percent of the bottoms of these areas. The hard-rock mine dumps generally are steep-sided piles of angular or irregularly shaped rock fragments from underground mine shafts. They contain no fines. Slopes range from gently sloping to extremely steep. Elevation ranges from 1,500 to 4,500 feet. Vegetation consists of an occasional ponderosa pine and scattered manzanita.

This land type is unsuitable for most farming uses. Its suitability for wildlife habitat is very limited. Essentially all the fine material has been washed from gravel deposits, and these deposits are used as a source of gravel for construction. Capability unit VIIIs–1 (18, 22).

Trabuco Series

The Trabuco series consists of well-drained soils underlain by weathered granodiorite. These soils are gently rolling to steep and are on the middle part of foothills. Slopes are 5 to 50 percent. The vegetation is mostly live oak, blue oak, digger pine, ceanothus, poison oak, manzanita, and annual grasses and forbs. Elevation ranges from 800 to 1,800 feet. The annual rainfall is 35 to 40 inches, and the average annual air temperature is 60° or 61° F. The frost-free season is 235 to 260 days.

In a representative profile the surface layer is 10 inches of reddish-brown loam and heavy loam. The subsoil is 57 inches of reddish-brown, dark-red, and yellowish-red clay loam and clay. Reaction is medium acid throughout. Weathered granitic rock is at a depth of about 67 inches.

Permeability is slow in the subsoil. Effective rooting depth is 42 to 60 inches or more. Available water holding capacity is 7 to 11 inches.

The Trabuco soils are used for annual range, irrigated pasture and improved dry pasture, watershed, and as wildlife habitat.

Representative profile of Trabuco loam, 5 to 15 percent slopes, 8½ miles northwest of Grass Valley, 1,400 feet north-northwest of the intersection of Pleasant Valley and Beckman Hill Roads, 600 feet north of the north quarter corner of sec. 9, T. 16 N., R. 7 E.:

Ap—0 to 4 inches, reddish-brown (5YR 4/4) loam, dark reddish brown (5YR 3/3) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable, sticky and plastic; common very fine roots; common very fine tubular and interstitial pores; medium acid; abrupt, wavy boundary.

A1—4 to 10 inches, reddish-brown (5YR 4/4) heavy loam, dark reddish brown (5YR 3/4) when moist; weak, medium and coarse, prismatic structure; hard, friable, slightly sticky and plastic; common very fine, fine, and medium roots; common very fine tubular and interstitial pores; medium acid; clear, smooth boundary.

B1—10 to 15 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (2.5YR 3/4) when moist; weak, medium and coarse, prismatic structure; hard, friable, sticky and plastic; common very fine, fine, and medium roots; common very fine tubular and interstitial and few fine tubular pores; common thin clay films on ped faces and in pores; medium acid; abrupt, wavy boundary.

B21t—15 to 29 inches, dark-red (2.5YR 3/6) clay, dark reddish brown (2.5YR 3/4) when moist; moderate, coarse, prismatic structure; hard, firm, sticky and very plastic; common very fine, fine, medium, and coarse roots; common fine and very fine tubular pores; continuous moderately thick clay films on ped faces and in pores; medium acid; clear, wavy boundary.

B22t—29 to 40 inches, dark-red (2.5YR 3/6) clay, dark reddish brown (2.5YR 3/4) when moist; moderate, coarse, prismatic structure; hard, firm, sticky and

very plastic; few very fine and fine roots; common fine tubular pores; continuous moderately thick clay films on ped faces and in pores; medium acid; clear, irregular boundary.

B31t—40 to 55 inches, dark-red (2.5YR 3/6) clay loam, dark reddish brown (2.5YR 3/4) when moist; moderate, coarse, angular blocky structure; hard, firm, slightly sticky and very plastic; few very fine, fine, and medium roots; common very fine tubular pores; many moderately thick clay films on ped faces and in pores; medium acid; gradual, wavy boundary.

B32t—55 to 67 inches, yellowish-red (5YR 4/6) clay loam, dark reddish brown (2.5YR 3/4) when moist; moderate, coarse, angular blocky structure; hard, firm, slightly sticky and very plastic; few very fine, fine, and medium roots; few very fine tubular pores; many moderately thick clay films on ped faces and in pores; medium acid; gradual, wavy boundary.

IIC—67 inches, variegated yellowish-red and red (5YR 5/6, 2.5YR 5/6) weathered granite, yellowish red (5YR 4/6) and red (2.5YR 4/6) when moist; massive; common thin clay films; slightly acid.

The A horizon ranges from brown, dark-brown, or yellowish-brown to strong-brown or reddish-brown loam, light loam, or heavy loam. It is slightly acid or medium acid in reaction and has granular, subangular blocky, or prismatic structure. In some places where irrigated pastures have been fertilized, the A horizon is strongly acid. A few quartz pebbles are in the A horizon in places.

In places a "stone line" of cobblestone-size fragments directly overlies the B2t horizon, generally in a B1 horizon. These fragments make up as much as 30 percent of the B1 horizon in places. The B2t horizon ranges from brown or reddish-brown to yellowish-red, dark-red, or red heavy clay loam or clay. This horizon ranges from neutral to medium acid in reaction. It is structureless (massive) or has angular blocky or prismatic structure.

The C1 horizon, where present, is light yellowish-brown, strong-brown, yellowish-red, red, and dark-red loam, clay loam, or heavy clay loam. The C1 horizon is structureless (massive).

The presence of mica or light and dark mineral grains is commonly apparent in the lower part of the B2, B3, and C horizons.

Depth to weathered granodiorite ranges from 42 to 60 inches or more.

Trabuco loam, 5 to 15 percent slopes (TrC).—This soil is generally gently rolling and rolling, but some areas are undulating. Rock outcrops cover as much as 10 percent of the surface area in most places. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Ahwahnee sandy loam, Auberry sandy loam, and Sierra sandy loam.

Runoff is medium on this soil. The hazard of erosion is moderate to high, depending upon slope.

This Trabuco soil is used for annual range, improved dry pasture, and irrigated pasture. Capability unit IVe–3 (18).

Trabuco-Rock outcrop complex, 15 to 30 percent slopes (TuD).—The Trabuco soil in this complex is hilly and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop, in exposures that are about 50 to 100 feet apart.

Included in mapping are small areas of Auberry sandy loam, Sierra sandy loam, and Shenandoah sandy loam.

Runoff is medium to rapid. The hazard of erosion is high.

This complex is used for annual range. Capability unit VIs–1 (18).

Trabuco-Rock outcrop complex, 30 to 50 percent slopes (TuE).—The Trabuco soil in this complex is steep and is on mountainous uplands. About 10 to 25 percent of this complex is Rock outcrop. About half of the Trabuco soil in this complex has lost about 25 to 50 percent of the surface layer through erosion. In these areas stones and rock outcroppings cover 25 to 50 percent of the surface area. This eroded soil is 24 to 36 inches deep.

Included in mapping are small areas of Auberry sandy loam and Sierra sandy loam.

Runoff is medium to rapid. The hazard of erosion is moderate to high.

This complex is used for annual range and as wildlife habitat. It is also used for watershed in the steeper and more rocky or stony areas. Capability unit VIIs–1 (18).

Use and Management of the Soils

In this section farming and other specific uses of the soils in the Nevada County Area are discussed.

First the capability grouping used by the Soil Conservation Service is presented, land resource areas are explained, and suggestions for managing soils in each capability group are given. Next, a discussion of yield estimates and management guides for the relative suitability of the soils for principal crops and for critical areas is given. Then vegetative groups are discussed, and in the following subsection, range management, and soils that have similar forage potentials are grouped into range sites.

In the subsection "Use of the Soils for Woodland," the potential of soils for woodland uses is given, and woodland management and suitable woodland practices are described. This is followed by discussion of use of soils for wildlife, engineering uses of the soils, and, finally, use of the soils for community development.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, the subclass, and the unit. These groups are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use. (No soils of the Nevada County Area are in Class I.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (No soils of the Nevada County Area are in Class V.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, and not at all in the Nevada County Area, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIe–8. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Capability units in classes I through IV in California are given numbers that suggest the chief kind of limitation responsible for placement of the soil in the capability class and subclass. For this reason, some of the units within the subclasses are not numbered consecutively, and their symbols are a partial key to some of the soil features. The numbers used to designate units within the classes and subclasses are these:

0.—Indicates that a problem or limitation is caused by stony, cobbly, or gravelly material in the substratum.

1.—Indicates that a problem or limitation is caused by slope or by actual or potential erosion hazard.

2.—Indicates that a problem or limitation of wetness is caused by poor drainage or flooding.

3.—Indicates that a problem or limitation of slow or very slow permeability of the subsoil or substratum is caused by a clayey subsoil or a substratum that is semiconsolidated.

4.—Indicates that a problem or limitation is caused by sandy or gravelly soils with a low available water holding capacity.

5.—Indicates that a problem of limitation is caused by a fine-textured or very fine textured surface layer.

6.—Indicates that a problem or limitation is caused by salt or alkali.

7.—Indicates that a problem or limitation is caused by rocks, stones, or cobblestones.

8.—Indicates that a problem or limitation exists in the root zone, which generally is less than 40 inches over massive bedrock and lacks moisture for plants.

9.—Indicates that a problem or limitation is caused by low or very low fertility, acidity, or toxicity that cannot be corrected by adding normal amounts of fertilizer, lime, or other amendments.

Soils in classes V through VIII are all given the number 1. The management of soils in these classes is explained in more detail in the sections "Use of the Soils for Range" and "Use of the Soils for Woodland."

Land Resource Areas

Because of the diversity of climate, topography, vegetation, and the general kinds of farming practiced in the Area, the Nevada County Area has been divided into two land resource areas and given the national designations 18 and 22 (*2*). Land Resource Area 18

consists of the lower and middle foothills, and Land Resource Area 22 of the mountainous uplands. A soil in one resource area may have characteristics similar to those of a soil in the other resource area and to be in the same capability unit, but the climate, vegetation, the kinds of crops that could be grown, and the use and management practices needed may vary widely. Consequently, the capability units of soils in the coniferous forests of the mountainous uplands at elevations generally from 1,800 to 4,700 feet are designated by the symbol (22). The capability units in the rest of the Area, generally below 1,800 feet, are designated by the symbol (18). For example, both capability units IIIe–1 (18) and IIIe–1 (22) contain deep, well-drained soils; but unit IIIe–1 (18) is in the middle or lower foothills, and IIIe–1 (22) is in the mountainous uplands.

Land Resource Area 18.—This land resource area is in the foothills of the Sierra Nevada mountain range. Vegetation is generally grass and oak. This area is rolling to steep and is dissected by rivers and streams that flow southwestward. Slopes are steep at the upper elevations, but gradually level off as they merge with the plains of the Great Central Valley. Elevation ranges from 300 to about 1,800 feet, and the average annual rainfall is 26 to 50 inches. The frost-free season is 225 to 265 days. This area is used mostly for livestock grazing. The soil associations on the general soil map in the physiographic region of the middle and lower foothills are in land resource area 18.

The major factors that limit the use of these soils are steep slopes, nearness of bedrock to the surface, stones and cobblestones in the soil material of profiles, rock outcrops, low available water holding capacity, low fertility, restricted drainage, and certain types of soil structure.

Basic facts and assumptions considered in establishing the capability classification for soils in Land Resource Area 18 are as follows:

1. Irrigation water is available, or considered to be available, for all soils more than 20 inches in depth. The soils may have other deficiencies, but they are not sufficient to restrict production of cultivated and irrigated crops. No attempt has been made to exclude tracts that possibly could not be irrigated because of location. It is assumed that the soil will be used at its highest productive potential with irrigation water and that rainfall in most years is adequate for dryfarmed crops commonly produced. The capability classification of soils that have severe or very severe limitations that preclude their use for cultivated crops is based on their productive capacity and the hazards if used for range or woodland.
2. A high level of management is assumed to be in effect.
3. The major crops produced in this land resource area are hay, irrigated pasture, dryland pasture, and deciduous fruit.
4. The frost-free period ranges from 225 to 265 days. It generally extends from March 10 to November 25. The average annual rainfall is 26 to 50 inches.

Land Resource Area 22.—This land resource area is part of the Sierra Nevada mountain range. It is characterized by hilly uplands, steep mountainous ridges, and narrow valleys that are more V-shaped as elevation increases. Ridges on volcanic conglomerate are generally gently sloping and tabular, but they have steep sides. Areas on slate are commonly angular and sharp. Wide mountain valleys in some places are present where a drainageway widens. This land resource area is bordered by rivers and laced by smaller streams and creeks. Elevation ranges from 1,800 to more than 5,000 feet, although it is as low as 1,000 feet in some places. Precipitation ranges from 30 to 60 inches and increases with increasing elevation. A large part of the precipitation falls as snow. The frost-free season is 135 to 260 days. The soils have formed mostly under forests of conifer and hardwood. All of the soil associations in the physiographic region of the mountainous uplands on the General Soil Map are in Land Resource Area 22.

The major factors limiting the use of these soils are low temperature in winter, steepness of slope, nearness of bedrock to the surface, stones and cobblestones in the soil, rock outcrops, low available water holding capacity, low fertility, and restricted drainage.

Basic facts and assumptions considered in establishing the capability classifications for soils in Land Resource Area 22 are as follows:

1. Irrigation water is available, or considered to be available, for all soils that are suited to cultivation. Deciduous orchards are grown on some of the soils in this resource area. No attempt has been made to exclude tracts that, because of their location, might not be irrigated. Much of this land resource area is in profitable stands of timber. As areas elsewhere in the United States are urbanized, it is expected that the acreage planted to crops will increase.
2. A high level of management is assumed to be in effect.
3. The major crops produced in this land resource area are timber, dryland pasture, hay, deciduous fruits, grapes, and irrigated pasture.
4. The frost-free period ranges from 135 to 260 days. It generally extends from April 15 to October 1. The average rainfall is 30 to 60 inches.

Management by Capability Units

The productivity and responses of a soil depend on many factors, especially the nature of the soil, climate in which it is located, and mangement it receives. Soil characteristics and climate cannot be changed readily. Management, on the other hand, is subject to control. Changes in the management of some soils can greatly change the quantity and quality of the crop. Recurring practices in management, depending on what kind they are, can establish a trend toward improvement, maintenance, or depletion of the soil in a field.

A good system of soil management is likely to consist of a combination of several practices. Among these are use of a good cropping system, use of crop residue, applications of fertilizer, and cultivating on the contour or across the slope. The effectiveness of any one practice is dependent upon others. For example, a diversion system for disposal of storm water

may cause gullying unless the water is directed into an adequately grassed waterway or other suitable channel or outlet.

Because of the wide variety of soil and climatic factors, it is desirable to group many of these combinations of practices for ease in handling and treating the soils. Such a grouping has been made in this section, which contains a description of each capability unit in the Nevada County Area, and suggestions for the use and management of the soils in each group.

The names of the soil series represented in each capability unit are mentioned, but this does not mean that all the soils in a given series are in the unit. For the soils in each capability unit, refer to the "Guide to Mapping Units" at the back of this survey. Further information about each kind of soil is given in the section "Descriptions of the Soils." Specific management of the soils in each unit for range, woodland, and wildlife is discussed in the other subsections "Use of the Soils for Range," "Use of the Soils for Woodland," and "Use of the Soils for Wildlife." Further information about climate is given in the appropriate subsections under "Formation and Classification of the Soils" and "General Nature of the Area."

CAPABILITY UNIT IIe–1 (22)

This unit consists of well-drained soils of the Aiken, Cohasset, Hoda, and Sites series. The surface layer ranges from sandy loam to heavy loam, and the subsoil ranges from clay loam to clay. Depth to bedrock is 40 inches or more. These soils formed over andesitic conglomerate, metasedimentary or metabasic rock, or granodiorite. They are on uplands. Slopes are 2 to 9 percent. The vegetation is mixed conifer and hardwood and some brush. The average annual precipitation is 40 to 60 inches. The growing season is 140 to 250 days.

Permeability in the subsoil is moderately slow. Runoff is slow to medium. Available water holding capacity is 6 to 12 inches. The hazard of erosion is slight to moderate.

These soils are used mostly for timber production. Some areas are used for deciduous orchards, irrigated pasture, and perennial dry pasture. These soils are suitable for vineyards.

Crop residue and animal manure should be returned to the soils of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope also helps control erosion. Cover crops can be grown in the orchards during the rainy season to control erosion.

These soils are easy to work in areas other than those having some cobblestones and outcroppings of rock. Crops in these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IIIe–1 (18)

This unit consists of well-drained soils of the Ahwahnee and Sierra series. The surface layer is sandy loam, and the subsoil is heavy sandy loam to sandy clay loam. Depth to weathered granitic bedrock is 30 to 60 inches or more. Slopes are 2 to 9 percent. The vegetation is generally oak and grass and some brush, but scattered growths of ponderosa pine also are present. The average annual precipitation is 28 to 45 inches. The growing season is 235 to 260 days.

Permeability is moderately rapid to moderately slow in the subsoil. Runoff is medium. Available water holding capacity is 4 to 9 inches. The hazard of erosion is slight to moderate.

These soils are used mostly for annual range, but they are also used for perennial dry pasture, irrigated pasture, and some forage crops. They are suitable for vineyards and orchards if irrigation water is available.

Plant residue and animal manure should be turned under on the soils of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope helps control erosion. Cover crops can be grown in the orchards during the rainy season to control erosion.

These soils are easy to work, but a few outcroppings of rock hinder tillage in places. Crops on these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IIIe–1 (22)

This unit consists of well-drained soils of the Aiken, Boomer, Cohasset, Hoda, Josephine, Musick, and Sites series. The surface layer ranges from sandy loam to heavy loam, and the subsoil ranges from clay loam to clay. Depth to bedrock is more than 40 inches. These soils formed in andesitic conglomerate, metasedimentary rock, metabasic rock, or granodiorite. They are on uplands. Slopes are mostly 9 to 15 percent, but are as little as 5 percent in places. The vegetation is mixed conifer and hardwood and some brush. The average annual precipitation is 30 to 60 inches. The growing season is 135 to 260 days.

Permeability is moderately slow or moderate. Runoff is slow to medium. Available water holding capacity is 6 to 12 inches. The hazard of erosion is slight to moderate.

These soils are used mostly for timber production. They are also used for deciduous orchards, irrigated pasture, and perennial dry pasture. They are suitable for vineyards.

Crop residue and animal manure can be turned under on the soils of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope helps control erosion. Cover crops can be grown in orchards during the rainy season to control erosion.

These soils are easy to work, but a few cobblestones and outcroppings of rock hinder tillage in places. Crops on these soils respond to applications of nitrogen and phosphorus.

CAPABILITY UNIT IIIe-8 (18)

Sobrante loam, 2 to 15 percent slopes, is the only soil in this unit. It is well drained. The surface layer is loam, and the subsoil is light clay loam. Depth to hard bedrock is 24 to 36 inches. This soil formed in metabasic rock. It is on uplands. Slopes are 2 to 15 percent. The vegetation is oak and grass and some brush. The average annual precipitation is 28 to 45 inches. The growing season is 240 to 260 days.

Permeability is moderate in the subsoil. Runoff is medium. Available water holding capacity is 3.5 to 6 inches. The hazard of erosion is slight to moderate.

This soil is used mostly for annual range, but it is also used for perennial dry pasture, irrigated pasture, and some forage crops. It is suitable for vineyards and orchards.

Plant residue and animal manure can be turned under on the soil of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope helps control erosion. Cover crops can be grown in the orchards and vineyards during the rainy season to control erosion.

This soil is easy to work, but a few outcroppings of rock hinder tillage in places. Crops on these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IIIw-3 (18)

Shenandoah sandy loam, 2 to 15 percent slopes, is the only soil in this unit. It is somewhat poorly drained. The surface layer is sandy loam, and the subsoil is dense clay. Depth to weathered bedrock is 27 to 40 inches. This soil formed in granodiorite. It is on mountainous uplands, commonly in swale positions. Slopes are 2 to 15 percent. The vegetation is oak and grass and some brush, and on the more poorly drained soils in swales, sedges and wiregrass. The average annual precipitation is 30 to 40 inches. The growing season is 240 to 260 days.

Permeability is very slow in the subsoil. Runoff is medium. Available water holding capacity is 3 to 5 inches. The hazard of erosion is slight to moderate.

This soil is used mostly for annual range, but it is also used for irrigated pasture and perennial dry pasture. It is suitable for small grains.

Plant residue and animal manure can be turned under on the soil of this capability unit. The use of plant residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope helps in preparing this soil for irrigated or dry pasture.

This soil has outcroppings of rock in places. Plants on this soil respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler. Overirrigation can be avoided, because of the very slow permeability of the subsoil. To prevent soil compaction it is best not to graze these soils when too wet.

CAPABLITY UNIT IIIw-5 (18, 22)

This unit consists of the moderately well drained to poorly drained land type Alluvial land, clayey. The surface layer and substratum range from clay loam to clay. Depth to bedrock is 30 to 45 inches. This land type formed in material deposited along stream channels and drainageways. It is in both resource areas and throughout the survey area. It is level or has slopes of as much as 15 percent. The vegetation is mostly annual grasses and forbs. The average annual precipitation is 28 to 60 inches. The growing season is 140 to 265 days.

Permeability is moderately slow to very slow in the subsoil. Runoff is slow. Available water holding capacity is 3.5 to 8 inches. The hazard of erosion is none to slight.

This land type is used mostly for annual range or pasture. It is suitable for small grains.

The use of crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility on the soils of this capability unit. Tillage on the contour or across the slope helps control erosion.

This land type contains significant amounts of gravel and cobblestones in the lower part of the profile in places. Plants respond to applications of nitrogen and phosphorus. If this land type is planted to irrigated pasture, irrigation is best applied by sprinkler to carefully control the amount of water applied. To prevent soil compaction, it is best not to graze this land type when too wet.

CAPABILITY UNIT IIIw-8 (18, 22)

This unit consists of the well-drained to poorly drained land type Alluvial land, loamy. This land type is loamy alluvial material that has been deposited along stream channels and drainageways. The parent material is from different rock sources. Depth to gravel, cobblestones, or underlying bedrock is 30 to 45 inches. The land type is undulating to rolling and is on uplands in both resource areas, scattered throughout the survey area. Slopes range from 0 to 15 percent. The vegetation is grasses and forbs. The annual precipitation is 28 to 60 inches, depending upon elevation. The frost-free season is 140 to 265 days.

Permeability is moderate in the soil material of this land type. Runoff is slow. Rooting depth ranges from 30 to 45 inches. The hazard of erosion is slight to moderate.

This land type is used for range, improved dry pasture, and irrigated pasture. It is suitable for small grains.

Annual plant residue should be left on the surface in order to maintain high forage production and control erosion.

Plants respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler, and care can be taken not to graze these soils when they are too wet. To prevent compaction, it is best not to till this land type when too wet.

CAPABILITY UNIT IVe-1 (18)

This unit consists of well-drained soils of the Ahwahnee, Auberry, and Sierra series. The surface layer

ranges from sandy loam to loam, and the subsoil is sandy loam to sandy clay loam. Depth to bedrock is 30 to 60 inches or more. These soils formed in granodiorite. They are on uplands. Slopes are 5 to 15 percent. In uncultivated areas the vegetation is oak and grass and some brush. The average annual precipitation is 28 to 45 inches. The growing season is 235 to 265 days.

Permeability is moderately rapid to moderately slow in the subsoil. Runoff is slow to rapid. Available water holding capacity is 4 to 9 inches. The hazard of erosion is slight to high.

These soils are used mostly for annual range, irrigated pasture, and improved dry pasture. They are suitable for vineyards and orchards.

Plant residue and animal manure should be returned to the soils of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope helps to control runoff and erosion. Cover crops can be grown in orchards and vineyards during the rainy season to control erosion.

These soils are easy to work, but a few scattered outcroppings of rock hinder tillage in places. Crops on these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IVe–1 (22)

This unit consists of well-drained soils of the Aiken, Boomer, Chaix, Cohasset, Horseshoe, Hotaw, Josephine, and Sites series. The surface layer ranges from sandy loam to loam or gravelly loam, and the subsoil ranges from heavy sandy loam to light clay. Depth to bedrock is 20 to more than 60 inches. These soils formed in granitic, metabasic, basic igneous, or sedimentary rock. They are on uplands. Slopes are 9 to 30 percent. The vegetation is mixed conifer and hardwood and some grasses and brush. The average annual precipitation is 35 to 60 inches. The growing season is 135 to 250 days.

Permeability is moderately rapid to moderately slow in the subsoil. Runoff is medium to rapid. Available water holding capacity is 3 to 12 inches. The hazard of erosion is moderate to high.

These soils are used mostly for timber production, but selected areas are used for deciduous orchards, irrigated pasture, and improved dry pasture. Small cleared areas are used for range. These soils are suitable for vineyards and orchards. Soils that have a sandy loam surface layer are not suitable for cultivation if slopes are greater than 15 percent.

Plant residue and animal manure should be returned to the soils of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility. Tillage on the contour or across the slope also helps to control erosion. Cover crops can be grown in the orchards and vineyards during the rainy season to control erosion.

These soils are easy to work, but a few scattered outcroppings of rock hinder tillage in places. Crops on these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IVe–3 (18)

This unit consists of well-drained soils of the Argonaut and Trabuco series. The surface layer is loam or gravelly loam, and the subsoil is clay or gravelly clay. Depth to hard bedrock is 18 to 60 inches or more. These soils overlie metabasic rock or granite. They are undulating to rolling. Slopes are 2 to 15 percent. The average annual precipitation is 26 to 50 inches. The frost-free season is 235 to 250 days.

Permeability is slow or very slow in the subsoil. Runoff is slow to medium. Available water holding capacity is 2.5 to 11 inches. The hazard of erosion is slight to high.

These soils are better suited to grazing than to other uses. They can be cultivated for the production of small grains, irrigated pasture, or improved dry pasture. If cultivated, a cover of grasses and legumes should be grown 4 years out of 5.

The use of crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility on the soils of this capability unit. Tillage across the slope helps to reduce runoff and control erosion.

These soils are difficult to cultivate. Crops respond to applications of nitrogen and phosphorus. Irrigation is best applied by sprinkler. Water should be applied at a slow enough rate to prevent a perched water table on top of the clayey subsoil.

CAPABILITY UNIT IVe–7 (22)

This unit consists of well-drained soils of the Cohasset and Hoda series. The surface layer ranges from cobbly loam to cobbly sandy loam, and the subsoil is cobbly clay loam to clay. These soils formed in andesitic conglomerate or granite. They are on uplands. Slopes are 2 to 30 percent. The average annual precipitation is 40 to 58 inches. The growing season is 140 to 250 days.

Permeability is moderately slow in the subsoil. Runoff is slow to rapid. Available water holding capacity is 5.5 to 12 inches. The hazard of erosion is slight to moderate.

These soils are used for woodland and orchards, and in some places, irrigated pasture. They are suitable for improved dry pasture.

The use of crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility on the soils of this capability unit. Tillage should be limited and across the slope.

Crops on these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IVe–8 (18)

This unit consists of well-drained soils of the Auburn, and Sobrante series. The surface layer is loam, and the subsoil is clay loam. Depth to bedrock is 14 to 36 inches. These soils formed in metabasic rock. They are on uplands. Slopes are 5 to 30 percent. The vegetation is generally oak and grass and some brush. The

average annual precipitation is 26 to 45 inches. The growing season is 235 to 265 days.

Permeability is moderate in the subsoil. Runoff is slow to medium. Available water holding capacity is 2 to 6 inches. The hazard of erosion is slight to moderate.

These soils are used mostly for annual range and provide some of the most productive range in the area. Small areas are used for irrigated and dry pasture. These soils are suitable for vineyards and shallow-rooted deciduous orchards.

Crop residue and animal manure should be returned to the soils of this capability unit. The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves soil fertility. Tillage on the contour or across the slope helps control erosion. Cover crops can be grown in orchards and vineyards during the rainy season to control erosion.

These soils are easy to work, but a few scattered outcroppings of rock hinder tillage in places. Crops respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IVe–8 (22)

Mariposa gravelly loam, 2 to 30 percent slopes, is the only soil in this unit. It is well drained. The surface layer is gravelly loam, and the subsoil is gravelly clay loam. Depth to bedrock is 15 to 30 inches. This soil formed in metasedimentary rock. It is on uplands. Slopes are 2 to 30 percent. The average annual precipitation is 40 to 60 inches. The growing season is 140 to 235 days.

Permeability is moderate in the subsoil. Runoff is medium. Available water holding capacity is 2 to 4 inches. The hazard of erosion is moderate.

This soil is used mostly for timber production and dry and irrigated pasture. It is also used for grazing to a limited extent, and is suitable for small grains. It is generally too shallow for orchards.

The use of plant residue helps control erosion, adds organic matter, maintains soil structure, and improves soil fertility. Tillage across the slope helps control sheet erosion.

Crops on this soil respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT IVs–7 (22)

This unit consists of well-drained soils of the Sites series and the Chaix series, thick solum variant. The surface layer is very stony loam, and the subsoil is clay loam to light clay. Depth to bedrock is 24 to 60 inches or more. These soils formed in metabasic, metasedimentary, or gabbodiorite rock. They are on uplands. Slopes are 2 to 15 percent. The vegetation is mixed conifer and hardwood and some brush. The average annual precipitation is 35 to 60 inches. The growing season is 140 to 240 days.

Permeability is moderately slow in the subsoil. Runoff is slow to medium. Available water holding capacity is 4 to 10 inches. The hazard of erosion is slight to moderate.

These soils are used for timber production, grazing, deciduous orchards, and irrigated pasture. They are suitable for vineyards.

The use of green-manure crops and crop residue helps control erosion, adds organic matter, maintains soil structure, and improves fertility on the soils of this capability unit. Tillage should be on the contour or across the slope. Cover crops are grown in the orchards and vineyards during the rainy season to help control erosion.

These soils are difficult to work because of stones on the surface. Crops on these soils respond to applications of nitrogen and phosphorus. Irrigation water is best applied by sprinkler.

CAPABILITY UNIT VIe–1 (18)

This unit consists of well-drained soils of the Ahwahnee and Sierra series. The surface layer is sandy loam, and the subsoil is heavy sandy loam and sandy clay loam. Depth to bedrock is 60 inches or more. These soils formed in granitic rock. They are on uplands. Slopes are 15 to 30 percent. The vegetation is oak and grass and some shrubs. The average annual precipitation is 28 to 45 inches. The growing season is 235 to 260 days.

Permeability is moderately rapid to moderately slow in the subsoil. Runoff is medium to rapid. Available water holding capacity is 4 to 9 inches. The hazard of erosion is high.

These soils are used mostly for annual range, but they are also used for perennial dry pasture or irrigated pasture. These soils are suited to seeding to adapted annual grasses and legumes.

Management practices such as rotation grazing, proper stocking, and use of water troughs and salt licks help to maintain an adequate cover and control erosion.

Outcroppings of rock cover as much as 10 percent of the surface area in places. Forage plants on these soils respond to applications of nitrogen and phosphorus.

CAPABILITY UNIT VIe–1 (22)

This unit consists of well-drained soils of the Aiken, Chaix, Cohasset, Hoda, Hotaw, Josephine, Mariposa, McCarthy, and Musick series. The surface layer is loam, heavy loam, or sandy loam. The subsoil ranges from heavy sandy loam to silty clay loam and clay. Some soils are gravelly or cobbly throughout. Depth to bedrock is mostly 20 to 60 inches or more. These soils formed in granitic, metabasic, basic igneous, or sedimentary rocks or andesitic conglomerate. They are on uplands. Slopes are mostly 15 to 50 percent, but some soils have slopes as gentle as 5 percent. The vegetation is mixed conifer and hardwood and some brush. The average annual precipitation is 35 to 58 inches. The growing season is 140 to 250 days.

Permeability is moderately rapid to moderately slow in the subsoil. Runoff is medium to rapid. Available water holding capacity is 2.5 to 12 inches. The hazard of erosion is moderate to high.

These soils are used mostly for timber production, but some areas are used for limited grazing. They are generally too steep for cultivation. Maintaining adequate plant residue helps control erosion.

CAPABILITY UNIT VIs–1 (18)

This unit consists of well-drained soils of the Ahwahnee, Argonaut, Auberry, Auburn, Rescue, Sierra, Sobrante, and Trabuco series, and Rock outcrop. The surface layer is loam or sandy loam, and the subsoil is sandy loam to clay. Some soils are gravelly throughout. Depth to weathered granitic or metabasic rock is 14 to more than 60 inches. These soils are on uplands. Slopes are mostly 15 to 30 percent, but range from 2 to 50 percent in places. The vegetation is oak, grass, and some brush. The average annual precipitation is 20 to 50 inches. The growing season is 235 to 265 days.

Permeability is moderately rapid to very slow in the subsoil. Runoff is slow to rapid. Available water holding capacity is 2 to 11 inches. The hazard of erosion is slight to high.

These soils are used mostly for annual range.

Sufficient plant residue should be maintained to help control erosion, add organic matter, maintain soil structure, and improve fertility.

Outcroppings of rock typically cover 10 to 25 percent of the surface area, but cover 25 to 50 percent in some areas. Plants on these soils respond to applications of nitrogen and phosphorus. These soils are not suited to irrigation.

CAPABILITY UNIT VIs–1 (22)

This unit consists of well-drained soils of the Boomer, Chaix, Hotaw, Josephine, Mariposa, Musick, and Sites series; Chaix series, thick solum variant; and Rock outcrop. The surface layer ranges from sandy loam to loam, and the subsoil ranges from sandy clay loam to clay. Some soils are gravelly throughout. Depth to bedrock is 15 to 60 inches or more. These soils formed in andesitic conglomerate, metasedimentary rock, metabasic rock, granitic rock, or basic igneous rock. They are on uplands. Slopes are 5 to 50 percent. The vegetation is mixed conifer and hardwood and some brush. The average annual precipitation is 30 to 60 inches. The growing season is 135 to 260 days.

Permeability is moderately rapid to moderately slow in the subsoil. Runoff is slow to rapid. Available water holding capacity is 2 to 11 inches. The hazard of erosion is slight to high.

These soils are used mostly for timber production and range. In areas used for range the soils respond to seeding to adapted plants, brush control, and fertilization. Care must be exercised in avoiding overgrazing to help control erosion.

Outcroppings of rock cover 10 to 25 percent of the surface area, or stones cover as much as 3 percent of the surface area of these soils.

CAPABILITY UNIT VIIe–1 (22)

This unit consists of well-drained and somewhat excessively drained soils of the Cohasset, Iron Mountain, Mariposa, Maymen, and McCarthy series. The surface layer is gravelly loam or cobbly loam, and the subsoil is gravelly loam to very cobbly loam or gravelly clay loam. Depth to rock ranges from 12 to 32 inches in most soils, but is 40 to 60 inches or more in some of the steepest soils. These soils formed in material weathered from andesitic conglomerate and metabasic and metasedimentary rock. They are on uplands. Slopes are 2 to 75 percent. The average annual precipitation is 40 to 60 inches. The frost-free season is 140 to 235 days.

Permeability is moderately rapid to moderately slow. Runoff ranges from medium to very rapid. Available water holding capacity ranges from 1 to 4.5 inches in the shallower soils, and from 5.5 to 9 inches in the deeper soils. The hazard of erosion is slight to very high.

These soils are used mostly for timber production, as wildlife habitat, and for watershed. Some areas are used for grazing.

Logging and the limited grazing operations must be managed carefully to avoid exposing the soil and to help control erosion.

CAPABILITY UNIT VIIs–1 (18)

This unit consists of well-drained soils of the Ahwahnee, Auberry, Auburn, Sierra, and Trabuco series; Dubakella series, shallow variant; Placer diggings and Rock outcrop. The surface layer is gravelly clay loam to sandy loam, and the subsoil is heavy sandy loam to clay or cobbly clay. Depth to bedrock is 10 to 60 inches or more. These soils formed in granodiorite metabasic and ultra basic rocks. They are on uplands. Slopes are 9 to 50 percent. The vegetation is oak and grass. The average annual precipitation is 20 to 45 inches. The frost-free season is 235 to 265 days.

Permeability is moderately rapid to very slow in the subsoil. Runoff is medium to very rapid. Available water holding capacity is 1.5 to 11 inches. The hazard of erosion is slight to very high. Rooting depth is 10 to 60 inches or more.

These soils are used for annual range and watershed. They are not suited to irrigated pasture or cultivation.

Maintaining adequate plant residue on the soils helps to maintain forage production and control erosion.

Outcroppings of rock cover 10 to 50 percent of the surface area.

CAPABILITY UNIT VIIs–1 (22)

This unit consists of well-drained soils of the Chaix, Dubakella, Hoda, Josephine, Mariposa, Maymen, and Secca series; Dubakella series, shallow variant; and Placer diggings and Rock outcrops. The surface layer ranges from gravelly silt loam to sandy loam, and the subsoil is heavy sandy loam to clay or cobbly clay. Depth to bedrock is 10 to 80 inches or more. These soils formed in granite rock, ultrabasic rock, metasedimentary rock, basic igneous rock, and metabasic rock. They are on uplands. Slopes are 2 to 75 percent. The vegetation is mixed conifer and hardwood and

some brush. The average annual precipitation is 35 to 60 inches. The growing season is 140 to 235 days.

Permeability is moderately rapid to slow in the subsoil. Runoff is medium to rapid. Available water holding capacity is 1 to 11 inches. The hazard of erosion is moderate to very high.

These soils are used for timber production and limited grazing, as wildlife habitat, and for watershed. They are too steep for cultivation.

Maintaining plant cover helps control erosion.

Outcroppings of rock cover 10 to 50 percent of the surface area.

CAPABILITY UNIT VIIIs–1 (18, 22)

This unit consists of Cut and fill land, Granitic rock land, and Tailings, areas of which have been subject to hydraulic mining. Depth to bedrock is variable but generally is less than 10 inches. The small amounts of soil material present are extremely cobbly, stony, or gravelly. Outcroppings of rock cover more than 50 percent of the surface in most places, except in areas of fills. Slopes range from 2 to 75 percent or more. These land types have very little vegetative cover. Drainage is excessive in some areas and extremely variable in others. Water stands in places in winter.

Runoff is rapid to very rapid. The hazard of erosion is slight to moderate, except on areas of granitic rock or cut and fill, where it is high to very high.

These land types are used as wildlife habitat and for watershed. They are also used as a source of gravel.

The existing sparse vegetation needs to be protected in order to control erosion and sedimentation on lower lying areas.

Estimated Yields and Management Guides

The yield estimates given in table 2 are based on information about the soils that was furnished by farmers, on observations made by the soil scientists who surveyed the Area and Soil Conservation Service crop specialists and technicians, and on suggestions furnished by the Agricultural Extension Service and the Nevada County Agricultural Commissioner. If little or no information about yields was available for a given soil or if a specific crop is not grown on a given soil, estimates were not made.

The yields of the principal crops grown on arable soils in the Area are estimated for a high level of management and are given in table 2. High-level management is defined as that management that will give the maximum return.

Several important factors should be taken into account when referring to the estimates in table 2: first, that the figures are estimates, or predictions; second, that the figures are the expected averages over a period of years, and in any given year, yield can be considerably more or less than average; third, that a considerable variation exists among some soils, and this was considered in making the estimates.

Also important to keep in mind is the fact that new advances and developments in such areas as crop breeding, control of insects and diseases, and the use of fertilizer, tillage, irrigation, and drainage are constantly being made. The latest information can be readily obtained from State and Federal farm advisory services.

Estimates of yields are of most use when the management practices under which such yields can be produced are specified. Soils used for cultivated crops need management that maintains or improves their fertility, keeps them in good tilth, and helps control erosion. The cultivated crops grown on the soils of the Nevada County Area are irrigated deciduous orchard crops, irrigated pasture crops, nonirrigated pasture crops, and some dryland field crops.

Following is a discussion of each principal crop, and of the soils of specific groups of capability units used for pasture crops. Each group describes the combination of practices that produce the yields given in table 2 for a high level of management. This information is most helpful when used in conjunction with table 2. Find in table 2 the crop, the name of the soil, the capability classification of the soil, and the estimated yield; then look at the appropriate crop and group of capability units in the following discussion to learn the details of management. Also provided is specific information for the management of critical areas.

IRRIGATED APPLES. If a winter cover crop is grown, cultivation practices include disking and dragging if desired. Where a plowpan exists, ripping breaks it up. Normally, a continuous self-perpetuating annual cover crop is planted. This cover crop is maintained by nontillage and cover-crop mowing. Fertilization includes 40 pounds of nitrogen per acre per year until the trees are mature. Excess nitrogen after maturity prevents proper coloring of apples. Young trees need phosphorus in the root zone. Once the roots have penetrated below the initial phosphorus application, no further applications of phosphorus are needed on most soils in the Area. Fertilization includes 100 pounds of nitrogen per acre per year for mature trees.

Irrigation is by sprinkler (fig. 10). Gross irrigation use is 4 acre-feet. Irrigation frequency is about 16 to 21 days during the period of peak use on soils that have a subsoil of clay loam. Application rate is approximately 3 inches in 24 hours. On sandy loam or very stony soil, irrigation frequency is about 10 to 14 days during peak use. A permanent cover crop under nontillage conditions is annual grasses and weeds, which are mowed. A permanent nontillage planted cover crop is 10 pounds of Lana vetch, or 3 pounds of burclover, or 3 pounds of subterranean clover and 4 pounds of Blando brome per acre. In a young orchard Lana vetch is not added to the seeding mixture because it twines on low, young trees. If a winter-growing cover crop is to be disked under, about 20 pounds of purple vetch, or 10 pounds of Lana vetch and 4 pounds of Blando brome, or 6 pounds of Wimmera *62* ryegrass, or 30 pounds of cereal grain per acre are planted. Harvesting of fruit is by hand. Selective pruning and measures to control insects and disease are carried on every year as needed. The soil is not cultivated when wet. Traffic is limited when soils are wet, to avoid compaction.

TABLE 2.—*Estimated average yields per acre of principal crops grown under a high level of management*

[Absence of data indicates that the soil is not suitable for the crop shown or that information is not available. Only arable soils are listed]

Soil	Irrigated				Dryland pasture
	Apples	Peaches	Pears	Pasture	
	Tons	*Tons*	*Tons*	*AUM*	*AUM*
Ahwahnee sandy loam, 2 to 9 percent slopes				10–12	2 4
Ahwahnee sandy loam, 9 to 15 percent slopes				8–10	2–4
Aiken loam, 2 to 9 percent slopes	12	7	8	8 -10	
Aiken loam, 9 to 15 percent slopes	12	7	8		
Aiken loam, 15 to 30 percent slopes	12	7	8	8–10	
Aiken cobbly loam, 2 to 30 percent slopes					
Alluvial land, clayey				10–12	
Alluvial land, loamy				10–12	
Argonaut gravelly loam, 2 to 15 percent slopes				10–12	2–4
Auberry sandy loam, 5 to 15 percent slopes				10–12	2–4
Auburn loam, 2 to 30 percent slopes				10–12	2–4
Boomer loam, 5 to 15 percent slopes				10–12	2–4
Boomer loam, 15 to 30 percent slopes				10–12	2–4
Chaix very stony loam, thick solum variant, 5 to 15 percent slopes				10–12	2–4
Cohasset loam, 2 to 9 percent slopes	12	7	8		
Cohasset loam, 9 to 15 percent slopes	12	7	8		
Cohasset loam, 15 to 30 percent slopes	12	7	8		
Cohasset cobbly loam, 5 to 30 percent slopes					
Hoda sandy loam, 5 to 9 percent slopes				8–10	
Hoda sandy loam, 9 to 15 percent slopes				8–10	
Hoda cobbly sandy loam, 2 to 15 percent slopes, eroded				8–10	
Josephine loam, 9 to 15 percent slopes				8–10	
Josephine loam, 15 to 30 percent slopes				8–10	
Mariposa gravelly loam, 2 to 30 percent slopes				8–10	
Musick sandy loam, 5 to 15 percent slopes				8–10	
Shenandoah sandy loam, 2 to 15 percent slopes				10–12	2–4
Sierra sandy loam, 2 to 9 percent slopes				10–12	2–4
Sierra sandy loam, 9 to 15 percent slopes				10–12	2–4
Sites loam, 2 to 9 percent slopes				8–10	
Sites loam, 9 to 15 percent slopes	12	7	8	8–10	
Sites loam, 15 to 30 percent slopes			7–8	8–10	
Sites very stony loam, 2 to 15 percent slopes			7–8	8–10	
Sobrante loam, 2 to 15 percent slopes				8–10	
Sobrante loam, 15 to 30 percent slopes				10–12	2–4
Trabuco loam, 5 to 15 percent slopes				10–12	2–4

[1] A.U.M. — Animal-unit-month. The figures represent the number of months that 1 acre can provide grazing for one animal unit (1,000 pounds of live weight) without injury to the pasture.

IRRIGATED PEARS AND PEACHES. Where a winter-growing cover crop is planted, management practices include disking and dragging. Where a plowpan exists, ripping breaks it up. Normally, a cover crop is grown that is used under nontillage conditions. Fertilization includes 100 pounds of nitrogen per acre per year. Mature trees in the Area have not shown a response to applications of phosphorus. Young trees are planted with one-half pound of single superphosphate in the root zone. After maturity, applications of phosphorus are discontinued.

Irrigation is by sprinkler at a rate of about 3 inches per 24 hours. Gross irrigation use is 4 feet. Irrigation frequency is about 16 to 21 days on soils that have a subsoil of clay loam. Sandy loam or very stony soils have an irrigation frequency of about 8 to 14 days during the peak-use period. In places, a permanent nontillage cover crop consists of annual grasses and weeds, which are mowed. For a permanent cover crop under nontillage conditions, a suitable seeding is 10 pounds of Lana vetch, or 3 pounds of burclover, or 3 pounds of subterranean clover and 4 pounds of Blando brome per acre. If a winter cover crop that is to be disked under is planted, a suitable seeding is 20 pounds of purple vetch or 10 pounds of Lana vetch and 4 pounds of Blando brome per acre or 6 pounds of Wimmera *62* ryegrass or 30 pounds of cereal grain per acre. Harvesting of fruit is by hand. Selected pruning and measures to control insects and disease are carried on every year as needed. The soil is not cultivated when wet, and movement of equipment across wet soil is avoided, to prevent compaction.

IRRIGATED PASTURE. Fertilization includes 30 to 35 pounds of phosphorus per acre and 120 to 150 pounds of nitrogen per year divided equally into 4 or 5 applications. Nitrogen is applied after each grazing period in a rotation cycle. Fertilizer is applied prior to irrigation or is added to the irrigation water. Other plant nutrients are applied if needed. Animal manure is used as a source of nitrogen and is supplemented by commercial fertilizer. Gross irrigation use is about 3.5 feet. Irrigation frequency is about every 8 to

Figure 10.—Sprinkler-irrigated apple orchard on Cohasset loam, 9 to 15 percent slopes.

10 days during the peak season but varies from 6 to 15 days. The more frequent irrigations are applied on the coarser textured soils; the less frequent, on finer textured soils. Irrigation is by sprinkler (fig. 11) or by contour ditches. New pasture is mowed to control weeds when grasses reach a height of 4 inches. The grass is grazed when it reaches a height of 8 inches, but is not grazed closer than 4 inches. Wet soils are not grazed, and grazed pasture plants are allowed 21 to 35 days for regrowth. Pastures are divided into 3 or more fields. The maximum growth period is from April 15 to October 15, and the stocking-rate cut is from October 15 to April 15. Coarse stems are mown to obtain uniform growth. Harrowing scatters animal droppings. In places, excess water is collected for reuse.

Specific management practices for groups of soils in capability units are given in the following paragraphs.

Group 1.—Soils of capability units IIe–1 (22), IIIe–1 (18), IIIe–1 (22), IVe–1 (18), IVe–1 (22), IVe–7 (22), and IVs–7 (22) are in this group. Where possible, the customary seedbed preparation includes plowing, disking, harrowing, and drilling 2 pounds of Calaverde or Lahontan alfalfa or 3 pounds of narrowleaf trefoil with 8 pounds of alta fescue per acre, or 5 pounds of Akaroa orchardgrass with 8 pounds of Prairie brome per acre. Prairie brome is superior to domestic ryegrass where a quick cover is desired. The legume seeds are inoculated and grass seeds are treated with a fungicide.

Group 2.—Soils of capability units IIIe–8 (18), IVe–3 (18), IVe–8 (18), and IVe–8 (22) are in this group. Where possible, the customary seedbed preparation includes plowing, disking, harrowing, and drilling 3 pounds of narrowleaf trefoil or 2 pounds of Ladino clover with 8 pounds of alta fescue or Goar fescue per acre, or 5 pounds of Akaroa orchardgrass and 8 pounds of Prairie brome per acre. Where elevation is more than 1,800 feet and precipitation is more than 40 inches, 3 pounds of narrowleaf trefoil or 2 pounds of Ladino clover, or both, are drilled with 5 pounds of Akaroa orchardgrass or 8 pounds of alta fescue per acre. The legume seeds are inoculated and grass seeds are treated with a fungicide. Prairie brome is superior to domestic ryegrass where a quick cover is desired.

Group 3.—Soils of capability units IIIw–3 (18), IIIw–5 (18), IIIw–5 (22), IIIw–8 (18), and IIIw–8 (22) are in this group. The soils in this group are wet most of the winter and much of the spring. They are often dry in summer, however, and they lend them-

Figure 11.—Sprinkler system of irrigated pasture on Boomer loam, 5 to 15 percent slopes.

selves to irrigated pasture. Seedbed preparation includes plowing where possible and disking and harrowing. A typical seed mixture includes drilling 3 pounds of narrowleaf trefoil or 2 pounds of Ladino clover with 8 pounds of alta fescue or goar fescue per acre, or 5 pounds of Akaroa orchardgrass with 8 pounds of Prairie brome per acre. Prairie brome is superior to domestic ryegrass where a quick cover is desired. In areas of more than 1,800 feet elevation and more than 40 inches of precipitation, 3 pounds of narrowleaf trefoil or 2 pounds of Ladino clover, or both, are drilled with 5 pounds of Akaroa orchardgrass or 8 pounds of alta fescue per acre. Care is taken not to cultivate these soils when they are too wet, to avoid soil compaction

DRYLAND PASTURE. Grazing starts after the plants reach a height of 6 to 8 inches, and plants are grazed to a height of 2 inches. Grazing management includes proper cross-fencing, stocking rates, crop residue management, development of water, fertilization, and placement of salt. Fertilization includes application of 30 to 40 pounds of nitrogen and 10 to 20 pounds of phosphorus before the first effective rainfall. The first year fertilizer is applied, these rates are doubled

Specific management practices by groups of capability units are in the paragraphs that follow.

Group 1.—Soils in capability units IIe 1 (22), IVe–7 (22), IVs–7 (22), VIe–1 (18), VIe–1 (22), IIIe–1 (18), IIIe 1 (22), IVe–1 (18), IVe–1 (22), and VIe–7 (22) are in this group. Where possible, seedbed preparation includes plowing, disking, harrowing, and drilling 10 pounds of Lana vetch and 4 pounds of Blando brome per acre. In selected areas where a longer grazing season is desired, Calaverde or Lahontan alfalfa is planted at 2 pounds per acre in alternate rows with 1 pounds of hardinggrass per acre. In places at elevations of more than 1,800 feet and more than 40 inches annual precipitation, subterranean clover is substituted for Lana vetch at the rate of 3 pounds per acre. Hardinggrass is not planted on shallow or coarse-textured, uniform soils, nor is it fertilized in the first year. The legume seed is inoculated, and the grass seed is treated with a fungicide.

Group 2.—Soils in capability units IIIe-8 (18), IVe-8 (18), IVe-8 (22), and VIe-8 (18) are in this group. Where possible, seedbed preparation includes plowing, disking, harrowing, and drilling 10 pounds of Lana vetch with 4 pounds of Blando brome per acre. Where elevation is more than 1,800 feet and rainfall more than 40 inches, 10 pounds of Lana vetch or 3 pounds of subterranean clover are drilled with 4 pounds of Blando brome per acre. In selected areas where soils are moderately deep and have a clay loam or sandy clay loam subsoil, 10 pounds of Lana vetch

or 3 pounds of subterranean clover are drilled with 4 pounds of hardinggrass per acre if a perennial grass is desired. Where Lana vetch and hardinggrass are grown in combination, the Lana vetch is overseeded on hardinggrass the second year. Hardinggrass is neither planted on shallow-soil nor fertilized the first year. In places, subterranean clover is substituted for Lana vetch where elevation is more than 1,800 feet and rainfall more than 40 inches.

Group 3.—Soils in capability units IIIw–3 (18), IIIw–5 (18), IIIw–5 (22), IIIw–8 (18), and IIIw–8 (22) are in this group. Where possible, at elevations of more than 1,800 feet and more than 40 inches of rainfall, seedbed preparation includes plowing, disking, harrowing, and drilling 10 pounds of Lana vetch and 4 pounds of Blando brome per acre. On the selected sites mentioned in Group 2, 3 pounds per acre of subterranean clover is a substitute for Lana vetch and 4 pounds per acre of hardinggrass is a substitute for Blando brome. In areas that remain wet through most of the summer, the seeding mixture is 3 pounds per acre of narrowleaf trefoil. At elevations of less than 1,800 feet, 5 pounds of reed canarygrass is added. Where elevation is more than 1,800 feet and rainfall is more than 40 inches, 3 pounds of narrowleaf trefoil or alsike clover is drilled with 8 pounds of alta fescue or Goar fescue per acre. Hardinggrass is neither planted in shallow soil nor fertilized the first year. Seedbeds are not prepared when these soils are too wet, to avoid soil compaction.

Group 4.—Soils in capability units IIIe–3 (18), IVe–3 (18), and IVe–3 (22) are in this group. Where possible, seedbed preparation includes disking, harrowing, and drilling 10 pounds of Lana vetch or 3 pounds of subterranean clover with 4 pounds of Blando brome per acre. Where the grazing season is to be extended, 4 pounds of hardinggrass per acre is substituted for Blando brome. The legume seed is inoculated, and the grass seed is treated with a fungicide. These soils are not cultivated when they are too wet, to prevent compaction of the clay subsoil.

CRITICAL AREAS. Critical areas are considered to be areas that need seeding after fire or after such other soil disturbances as those at cut-and-fill sites, road-building sites, dams, and construction embankments. They can also be eroded areas or areas subject to erosion. Such critical areas can result from either agricultural or nonagricultural activities.

For seeding critical areas where adequate water is available, 12 pounds of alta fescue is planted per acre. In areas of more than 2,500 feet elevation, 12 pounds of either alta fescue or Topar wheatgrass is planted per acre if water is adequate. These mixtures are seeded at elevations ranging from 300 to more than 2,500 feet and apply to vegetative groups A, E, and G.

For seeding critical areas where no water is available, 15 pounds of Lana vetch or 6 pounds of Blando brome, or both, is planted per acre. If a temporary cover is desired, 60 pounds of cereal grain or 9 pounds of Wimmera *62* ryegrass per acre is planted. If a temporary cover is desired in areas where the subsoil is clayey, 60 pounds of cereal grain is planted per acre. On moderately deep soils Cucamonga brome is substituted for Blando brome. On soils in vegetative group J, Wimmera *62* ryegrass is planted with 6 pounds of Lana vetch per acre or 10 pounds of Lana vetch is planted per acre. If soils are suitable, Wimmera *62* ryegrass, Lana vetch, or both, are planted in burned areas as emergency seeding. For such seeding, 6 pounds of Wimmera *62* ryegrass per acre is planted for short-term cover. For self-perpetuating forage, 10 pounds of Lana vetch or 4 pounds of Blando brome per acre, or both, are used.

For temporary cover on critical areas of more than 2,500 feet elevation, 60 pounds of cereal grain is planted. An alternative seeding is 12 pounds of Topar wheatgrass per acre, or 8 pounds on burned areas as emergency seeding. On moderately deep soil, cereal grain is seeded at the rate of 60 pounds per acre or Wimmera *62* ryegrass is seeded at 9 pounds per acre if the cover is only temporary.

Where possible, areas to be seeded have a firm seedbed previously roughened by disking, harrowing, or raking. Except in crusted areas, newly constructed slopes can generally be seeded in the fall following construction with little or no seedbed preparation. Slopes exposed in previous years should be scarified.

Where it is possible, fertilizer should be distributed uniformly on the area to be seeded just prior to seeding or at the time of seeding. A minimum of 80 pounds of available nitrogen and 35 pounds of phosphorus are applied per acre. Fertilizer is broadcast or applied by hydraulic applicator, either a hydroseeder or a hydromulcher (fig. 12). Where a hydraulic applicator is used, seed, fertilizer, and wood-fiber mulch can be applied in one operation, thus keeping seedbed preparation to a minimum.

Wood-fiber mulch used with or without seed and fertilizer is applied at a rate of 1,200 to 1,500 pounds per acre. In places the mulch, seed, and fertilizer are applied in a slurry. In other places the mulch is ap-

Figure 12.—Woodpulp and resin with grass seed mix being sprayed as a bank-holding medium in erosion control.

plied in a separate operation immediately after broadcast seeding. Where straw mulch can be applied at a rate of 2 tons per acre, it is generally superior to wood-fiber mulch. The straw should be free of weed seeds and must be either incorporated by a heavy mulching coulter or held in place by a jute-mat netting or other mechanical means. The mulching coulter must be used from above where slope ratio exceeds 2½ feet rise in elevation to 1 foot linear distance.

Irrigation for the establishment of both annual and perennial vegetation always needs to be evaluated. Where irrigation is practical, it greatly enhances the establishment and effectiveness of the vegetative cover. Mulching reduces seedling mortality, conserves soil moisture, and helps to reduce erosion on steeper soils.

Nonirrigated seedings are begun after September 15 and completed, when conditions permit, by October 15.

Where slopes are sufficiently gentle (ratio of 3 to 1 or less), seeding is done with a grain drill. On steeper soils the seed must be broadcast. Either a hand or hydraulic seeder is used.

Vegetative Groups

A vegetative group is a grouping of soils having similar properties and qualities from the standpoint of plant adaptation and use. This grouping is used chiefly for determining the plants most suited to conservation practices and production of forage plants when the major limiting soil feature or problem is known. Irrigation and such climatic factors as precipitation, maximum and minimum temperatures, and length of growing season are separate factors not covered here. The system is statewide, but only five of the groups in the system are in the Nevada County Area. Consequently, they are not necessarily presented in alphabetic order. The following paragraphs define the vegetative groups in this survey area.

Group A—Choice of plants not limited by the soils. Soils in this group are mostly more than 40 inches deep to hard rock or have a very slowly permeable, clayey subsoil. The surface layer ranges from sandy loam to clay loam. Permeability in the subsoil is moderately rapid to moderately slow. Available water holding capacity is generally more than 5 inches for the effective rooting depth.

Group D—Choice of plants limited by a very slowly permeable subsoil. Soils in this group are mostly less than 40 inches deep to a very slowly permeable clay subsoil. The surface layer is sandy loam to loam and is gravelly in places. Available water holding capacity is 2.5 to 6 inches for the profile.

Group E—Choice of plants limited by wetness. The dominant soil materials of the land types in this group are 30 to 45 inches deep and are moderately to very slowly permeable. Texture and available water holding capacity are variable. A water table is present in places.

Group G—Choice of plants limited by depth. Soils in this group are mostly less than 40 inches deep to bedrock. Permeability is moderately rapid to slow. The surface layer ranges from sandy loam to clay loam, but in places is gravelly to very stony. Rock outcrops are common in many areas. Available water holding capacity generally is 2 to 8 inches for the profile.

Group J—Choice of plants depends upon onsite investigation. Most soils or land types in this group are in capability classes VII or VIII. They are not well adapted to normal methods or procedures of cultivation.

Use of the Soils for Range

About 35 percent of the total acreage of the Nevada County Area is used for pasture and range. This acreage is mostly in the western part of the Area, but it extends eastward to elevations that range generally from 1,700 to 2,000 feet. About one-fourth of this acreage is Auburn soils. The Ahwahnee, Sobrante, Sierra, Trabuco, Auberry, Rescue, and Argonaut soils are other important forage producers. Between elevations of 1,500 and 2,000 feet, vegetation gradually changes from grass to timber. Generally, the soils here are used for pasture and range, and are too steep, too shallow, or too rocky for cultivated crops. A significant acreage used for grazing, however, is suitable for cultivation. Also, significant areas that have value for grazing are along stream channels, in meadows, and on shallow, stony ridge tops within timbered areas. In places these areas have been cleared of trees and used to provide forage.

Livestock production is mostly limited to beef cattle. Cow-calf operations and cattle for stocker and feeder operations are about equal (*5*). Small numbers of dairy animals such as sheep, goats, and swine are also produced.

Most of the cattle are in cow-calf herds and graze range areas in the lower foothills in winter and early in spring. Some operators use federal grazing permits in summer. Others go to other parts of the state or out of state for summer feed. A few keep their stock in the Area all year and use irrigated pasture, and in summer, annual dry pasture and range. Many small part-time cattle operations, mostly those of the stocker-feeder type, depend on irrigated pasture and annual dry pasture for feed.

Subdivisions have taken large acreages of land previously used for winter and early spring grazing. As the population of the Area increases, more acres of grazing land are expected to be put to other uses.

Range sites

A range site is a distinctive kind of range that has potential to produce native plants. Each site differs from the others in its ability to produce significantly different varieties and amounts of vegetation. Each site also has a different potential for production of forage and presents different management problems.

Most of the important forage plants in the survey area have been introduced. The original forage plants were a mixture of perennials and annuals, and the introduced plants are mostly annuals. The annuals grow during cool weather. They take full advantage of the available moisture, produce seed, and mature before all the moisture is gone. These plants furnish highly

nutritious feed in spring, when they are green and growing. After maturity, however, their nutritional value is low.

A range site is a product of all the environmental factors that help to make it up. In the absence of disturbance and physical site deterioration, a given range site supports a plant community characterized by an association of species different from that of other range sites in the kind or proportion of species or in the total annual yield. The range condition is the present state of vegetation of a range site in relation to the plant community for the site that is possible under conditions of normal climate and best practical management.

Management of grazing is needed to encourage a desirable mixture of plants. Such management must take into account the successive though overlapping stages of growth in grasses and forbs; that is, the growth of roots and leaves, the formation of flower stalks, and the production of seed. Grazing must be regulated to allow these successive stages to proceed; otherwise, high yields of forage and profitable gains in animal weight is not possible.

Livestock graze selectively, seeking out the palatable and nutritious plants. If grazing is not carefully regulated the better, more desirable plants are weakened or eliminated, and less desirable plants increase. If grazing pressure continues even the less desirable, second-choice plants are thinned out or eliminated and undesirable, unpalatable plants take their place or the soil is left barren. Conversely, if grazing land is too lightly grazed or is left ungrazed for years, ripgut brome and other rank, less desirable plants increase.

Experiences of ranchers and studies by research workers show that if only part of the yearly growth of grass is grazed, damage to the more desirable plants is minimized and the vegetation can reach maximum production. Generally, from 700 to 1,000 pounds per acre of the forage should be left ungrazed on gently sloping to moderately steep soils, and from 1,000 to 1,300 pounds per acre on steep and highly erodible soils. Management practices that maintain or improve the vegetation are needed on all sites.

Facts and practices common to all the range sites in the Area and the effect of weather on forage production are described in the following paragraphs.

Proper grazing use and grazing readiness are important. Proper grazing use means that range is grazed in such a way that desirable vegetation is maintained or increased and that enough vegetation is left to protect the soil and control erosion. If the vegetation is properly used, it has a patchy appearance at the end of the growing season. Also, some plants will be untouched or partly grazed, and partly decomposed plant residue will be on the surface. Grazing readiness is defined as the time in the growing cycle when forage is sufficient to keep livestock healthy and the soil is dry enough to support livestock without damage to the plants or the soil.

Seeding is done to establish adapted perennial or annual grasses and legumes. It restores vegetation in poor condition or establishes grass on soils converted from other uses. Seeding helps to control the loss of soil and water.

Fertilizer is needed to improve forage on the large acreages of the Loamy, Shallow Loamy, and Granitic range sites. Response of these soils is best if both nitrogen and phosphorus are applied. In places, sulfur stimulates growth of legumes. If ammonium phosphate is applied the date of grazing readiness is advanced, the quantity and nutritional value of the forage is increased, and the growing season is lengthened. Fertilized areas should be fenced to prevent overgrazing.

Brush control is needed on some sites to improve vegetation and make handling of livestock easier. In places undesirable plants can be controlled by mechanical or chemical means. Controlled burning can be used in places to eliminate undesirable kinds of brush.

Other practices helpful in managing range include fencing, salting, and watering. These practices also make it easier to control livestock.

Adequate fencing is necessary to maintain the quality of livestock and keep the vegetation in good condition. It enables the operator to move stock to new ranges so that an adequate amount of residue is left on the soil and the production of forage is more uniform.

Salting can be used to improve the distribution of grazing, thus making the use of vegetation more uniform. The salt should be placed away from water so that livestock will be drawn into areas that would otherwise be grazed infrequently.

Water should be located at various places so that vegetation will be grazed more evenly. A large number of ponds to provide water for stock have been constructed in the Area, but many more are needed if vegetation is to be more fully used.

Weather has a greater effect on the production of forage in the Area than any other single factor. Forage production is a direct result of the date of the first significant fall rains, the duration and frequency of subsequent rain, and the temperature in fall, winter, and spring. All the range sites vary in total forage fall. Differences in distribution of rainfall and varia- production because of the yearly fluctuation in rain- tions in temperature result in even greater fluctuations of forage production. In addition to affecting forage production, weather affects the plant composition to a considerable extent. For example, some years are commonly called either "good clover years" or "poor clover years" because of the abundance or lack of burr clover on soils where it is adapted.

Most of the soils used for range are shallow or, at best, moderately deep, and have a moderate to low available water holding capacity. Generally, annual forage plants are shallow rooted and can utilize soil moisture fully only to the extent of their root system. On the one hand, if extended dry periods occur when temperatures are high enough to promote good plant growth, annual forage plants are likely to be damaged by drought. On the other hand, if moderate amounts of moisture fall and favorable growing temperatures prevail, yields of forage are good, even on shallow soils.

The lowest average annual precipitation in the area is about 26 inches. In years when rainfall is below normal but the seasonal distribution is good, sufficient moisture is available for good yields. From 85 to 90 percent of the 20 to 45 inches of average annual rainfall in the rangeland zone falls during the 6 months between November 1 and April 30. Thus, annual plants that grow in cool weather can take advantage of the moisture when it is present.

The soils of the survey area used for range have been grouped into six range sites. These sites are in one general climatic zone. Estimates of total annual air-dry production, made for each site, are based on total production of all kinds of plants on the range.

The range site descriptions include a brief description of the soils of the site, as a group; a listing of the important desirable, less desirable, and undesirable forage plants; and the acreage and general location of the sites in the survey area.

For these range sites, estimates of total potential annual production for favorable and unfavorable years are given. Stocking rates and carrying capacities, however, should not be computed from the total annual production. As the operator becomes familiar with the seasonal grazing readiness and production of his range by range sites, his judgment will determine the best grazing management plan. Local Soil Conservation Service technicians and farm advisors can assist in determining initial stocking rates, which should be made only after onsite inspection.

The figures for total annual production are for production without fertilization on an air-dry basis for each site and are based on a limited number of clippings, knowledge of the site, and estimates. Extremes in weather conditions can cause an even greater range in production than that listed for the site.

The figures for the total estimated annual production that livestock could graze on each site refer to total forage available to livestock, and are not to be interpreted as all usable forage. Also, soil series are mentioned in each range site, but this does not mean that all the soils in a series are in that range site. Some soils have not been placed in a range site, because they are not suited to use as range or are better suited to other uses. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

SHALLOW LOAMY RANGE SITE

This range site consists of well-drained loams and gravelly loams of the Auburn series and areas of Rock outcrop. These soils are 14 to 27 inches deep over bedrock. This range site is one of the most extensive in the Nevada County Area. It occupies about 32,000 acres in the southern, southwestern, and northwestern parts of the Area. The soils are undulating to steep. Slopes range from 2 to 50 percent, but on three-fourths of the site slopes are greater than 10 percent. Elevation ranges from 300 to 1,800 feet. Average annual rainfall ranges from 26 to 35 inches.

Permeability is moderate in the soils of this range site. Runoff is slow to rapid, and the hazard of erosion is slight to high. Available water holding capacity is 2 to 4 inches.

This site has a cover of open grass or grass and oak and some brush and digger pine. The oak and brush increase as elevation and rainfall increase, and in some areas stands are dense. If the site is producing at potential, about 70 percent of the plant cover is a mixture of soft chess, wild oats, clover, filaree, and other desirable plants, including remnant perennial grasses. About 20 percent is ripgut brome, annual fescue, annual lupine, and other less desirable plants. The remaining 10 percent is made up of such undesirable plants as nutgrass, silver hairgrass, tarweed, popcornflower, turkeymullein, and medusahead.

The soils of this range site, except for those having slopes of more than 30 percent, are well suited to seeding to annual grasses and legumes. Plants respond to nitrogen and phosphorus. Repeated applications of phosphorus are needed to maintain good stands of legumes.

The removal of trees and brush increases production on this site, except where slopes are more than 30 percent. If this site is not improved, the total estimated annual production ranges from 3,000 pounds per acre in favorable years to 1,000 pounds per acre in unfavorable years. If this site is improved and fertilized, the total annual production is increased about one and one-half to two and one-half times. The total estimated annual production that livestock can graze is 2,700 pounds per acre in favorable years and 800 pounds per acre in unfavorable years.

Rock outcrops cover as much as 50 percent of the surface area of this site, but in most places they do not impede livestock movement.

LOAMY RANGE SITE

This range site consists of well-drained loams of the Boomer, Rescue, and Sobrante series and areas of Rock outcrop. Depth to bedrock is 24 to more than 60 inches. Also in this site are areas of Boomer soils, generally in woodland but used for range as well. This site occupies approximately 23,000 acres in the southern, southwestern, and northwestern parts of the Nevada County Area. The soils are undulating to steep. Slopes range from 2 to 50 percent, but they are mostly 15 to 30 percent. The steep phase of this site has slopes of 30 to 50 percent. Elevation ranges from 400 to 2,000 feet. Average annual rainfall ranges from 28 to 45 inches.

Permeability is moderate to moderately slow. Runoff is medium to rapid, and the hazard of erosion is slight to high, depending upon slope. Available water holding capacity is 3.5 to 10 inches.

This site has a cover of open grass, grass and oak, and some brush, digger pine, and open stands of ponderosa pine on the northern slopes. The oak and brush generally increase as elevation and rainfall increase, and in some areas stands are dense. If the site is producing at potential, about 70 percent of the plant cover is a mixture of soft chess, wild oats, burclover, filaree, and other desirable plants, including remnant perennial grasses. Approximately 20 percent is ripgut brome, annual fescue, annual lupine, and other less de-

sirable plants. The undesirable plants silver hairgrass, tarweed, turkeymullein, and medusahead are present in places.

The soils of this range site are well suited to seeding to annual grasses and legumes. Plants respond to nitrogen, phosphorus, and sulphur. Repeated applications of phosphorus are needed to maintain good stands of legumes on the Rescue and Sobrante soils.

The removal of trees and brush also increases production on this site. If this site is unimproved, the total estimated annual production ranges from 3,500 pounds per acre in favorable years to 1,200 pounds in unfavorable years. If this site is improved and fertilized, the total annual production is increased two to four times. The total estimated annual production that livestock can graze is 3,200 pounds per acre in favorable years and 1,000 pounds in unfavorable years.

Rock outcrops cover as much as 25 percent of the surface area of this site, but they do not impede livestock movement.

GRANITIC RANGE SITE

This range site consists of well-drained and somewhat poorly drained sandy loams or loams of the Ahwahnee, Auberry, Shenandoah, Sierra, and Trabuco series and areas of Rock outcrop. Depth to granitic bedrock is 27 to more than 60 inches. This site is one of the most extensive in the Nevada County Area. It occupies about 39,000 acres in the west-central and northwestern sections of the western part of the Area. The soils are undulating to steep. Slopes range from 2 to 50 percent. The steep phase of this site has slopes greater than 30 percent. Elevation ranges from 400 to 2,000 feet. Average annual rainfall ranges from 20 to 45 inches.

Permeability is moderately rapid to very slow in the soils of this range site. Runoff is slow to rapid, and the hazard of erosion is slight to very high, depending upon slope. Available water holding capacity is 3 to 11 inches.

This site has a cover of open grass or grass and oak and some brush and digger pine. The oak and brush increase as elevation and rainfall increase, and in some areas stands are dense. If the site is producing at potential, about 70 percent of the plants is a mixture of soft chess, wild oats, burclover, filaree, and other desirable plants, including remnant perennial grasses. In addition to burclover, other annual clovers grow well during favorable years. About 20 percent of the plant cover is ripgut brome, annual fescue, annual lupine, and other less desirable plants. The remaining 10 percent is made up of such undesirable plants as nutgrass, silver hairgrass, tarweed, turkeymullein, medusahead, and others.

The soils of this range site, except for those having slopes of more than 30 percent, are well suited to seeding to annual grasses and legumes. Plants respond to nitrogen, phosphorus, and sulfur. Repeated applications of phosphorus are needed to maintain good stands of legumes on the Ahwahnee, Auberry, Sierra, and Trabuco soils.

The removal of trees and brush increases production on this range site. If this site is unimproved, the total estimated annual production ranges from 3,500 pounds per acre in favorable years to 1,000 pounds per acre in unfavorable years. If this site is improved and fertilized, the total annual production is increased two to four times. The total estimated annual production that livestock can graze is 3,200 pounds per acre in favorable years and 800 pounds per acre in unfavorable years.

Rock outcrops cover as much as 50 percent of the surface in some areas of this site. In these areas, livestock movements are somewhat restricted, and the total herbage production is reduced. In most places these areas are brushy, and the soils have slopes of more than 30 percent.

SERPENTINE RANGE SITE

This range site consists of well-drained loams or gravelly clay loams of the Dubakella series and the Dubakella series, shallow variant, and areas of Rock outcrop. Depth to serpentinized ultrabasic bedrock is 10 to 24 inches. These soils have a subsoil of cobbly clay or clay. This site is the least extensive in the Nevada County Area. It occupies about 3,400 acres, mostly south-southwest of Grass Valley. The soils are undulating to steep. Slopes range from 2 to 50 percent. Elevation ranges from 1,200 to 2,200 feet. Average annual rainfall ranges from 35 to 54 inches.

Permeability is slow to very slow. Runoff is slow to rapid, and the hazard of erosion is slight to high, depending upon slope. Available water holding capacity is 1.5 to 3 inches.

This site generally has a cover of open grass or oak and grass and digger pine and brush. Some areas have almost solid stands of brush. If this site is producing at potential, about 50 percent of the plant cover is a mixture of soft chess, filaree, wild oats, some burclover and other desirable plants, and remnants of purple needlegrass and squirrel tail. About 35 percent is such less desirable plants as red brome, moss barley, annual lupine, and larger amounts of annual fescue. About 15 percent is such undesirable plants as owlclover, brodiea, and vinegar weed. The dominant brush is chamise, yerba santa, toyon, and deer brush.

The soils of this range site are not suited to seeding or fertilization, because of the low fertility that is a result of a content of low calcium and high magnesium.

Rock outcrops cover 10 to 50 percent of the surface area of this site, but livestock movements are not seriously restricted, and total herbage production is not greatly reduced.

The removal of vegetation is not feasible because of the relatively low fertility of this site. If this site is unimproved, the total estimated annual production ranges from 1,200 pounds per acre in favorable years to 600 pounds per acre in less favorable years. The total estimated annual production that livestock can graze is 900 pounds per acre in favorable years and 400 pounds per acre in unfavorable years.

PLACER DIGGINGS RANGE SITE

Only Placer diggings is in this range site. This site occupies about 6,400 acres throughout the Nevada County Area. It consists of variable soil material in

stream channels, swales, and areas of hydraulic mining. The areas in stream channels are long and narrow. They are near, and in many cases within, areas of Tailings. Elevation ranges from 400 to 4,500 feet. Slopes range from 2 to 75 percent. Average annual rainfall ranges from 28 to 55 inches.

The material in this site consists of debris left by placer mining or stream action. It is a mixture of various soil materials. The surface is often scarred and uneven. All areas generally contain some fine soil material suitable for growing varying amounts of forage. Parts of this site are as much as 90 percent stones, cobblestones, or gravel. The soil material is shallow to deep and in many places is underlain by coarse sand, gravel, or bedrock. In places rock outcrops are present along streams.

Drainage and permeability vary. Areas in streambeds are subject to flooding in winter. Reaction is variable. Parts of this site contain seep or wet areas in places.

Vegetation on this site varies. Many areas support a dense stand of trees and brush and an understory of annual and perennial plants, both forbs and grasses. In some areas annual grasses and forbs dominate. The main tree and brush species are willow, alder, cottonwood, blackberry, wild rose, poison oak, live oak, and white oak. These generally do not add much to the usable forage. Poor to moderately good stands of ponderosa pine are present in places at higher elevations. Desirable grasses and forbs that furnish most of the forage on this site are bluegrass, blue wildrye, mountain brome, sedge, soft chess, annual clover, and filaree. Stinging nettle, horehound, wormwood, deergrass, curlyleaf dock, wiregrass, and other undesirable plants are also present.

Forage production varies extremely depending on the soil material present; it varies greatly within short distances. Areas of this site generally are too narrow for reseeding. The soil material is also too variable for reseeding. Fields would not justify the cost of fencing and other management needs. Because of annual flooding the hazard of erosion is severe if areas are left unprotected in winter. Applying fertilizer on this site is not feasible.

In small areas of this site dense stands of trees and brush could be thinned and use of the site thus improved. The expense of clearing for increased yields alone would not be justified, however, because intensive practices are also required to prevent regrowth of brush.

CLAYPAN RANGE SITE

This range site consists of well-drained gravelly loams of the Argonaut series and areas of Rock outcrop. Depth to claypan is 18 to 36 inches. This site is one of the least extensive in the Nevada County Area. It occupies about 1,900 acres in the southern, southwestern, and northwestern parts of the Area. The soils are undulating to moderately steep. Slopes range from 2 to 30 percent. Elevation ranges from 300 to 2,500 feet. Average annual rainfall ranges from 26 to 50 inches.

Permeability is very slow in the subsoil. Runoff is slow to medium. Available water holding capacity is 2.5 to 4 inches.

This site has a cover of grass or grass brush and oak. The oak and brush do not generally increase as elevation and rainfall increase. The claypan is the limiting factor on this range site. If the site is producing at potential, approximately 70 percent of the plant cover is a mixture of soft chess, wild oats, burclover, filaree, and other desirable plants, including remnants of perennial grasses. This plant population is in the well-drained areas of this range site. Approximately 20 percent is ripgut brome, annual fescue, annual lupine, and other less desirable plants. The remaining 10 percent is made up of such undesirable plants as nutgrass, silver hairgrass, tarweed, popcornflower, turkeymullein, medusahead, and others. In areas that are less sloping and remain wet for longer periods, wiregrass and sedge are present. Plants on this range site stay green longer in spring than plants on the Shallow Loamy range site because of the position and the clay subsoil, or both.

The soils of this range site are suited to seeding to annual grasses where they are well drained. Specific seeding mixtures can be applied where these soils remain wet for longer periods. Annual clover can also be planted on these soils. Plants respond to nitrogen and phosphorus. Repeated applications of phosphorus are needed to maintain good stands of legumes.

The removal of trees and brush increases production on this site. If the site is unimproved, the total estimated annual production ranges from 3,500 pounds per acre in favorable years to 1,200 pounds per acre in unfavorable years. If this site is improved and fertilized, forage production is increased by three to four times. The total estimated annual production that livestock can graze is 3,000 pounds per acre in favorable years and 1,000 pounds per acre in unfavorable years.

Rock outcrops cover as much as 25 percent of the surface area of this site, but they do not impede livestock movement.

Use of the Soils for Woodland [2]

Forests are one of the important resources of the Nevada County Area. They supply raw material for one of the major industries, provide recreation and esthetic enjoyment for many people, provide food and cover for many forms of wildlife, and protect watersheds.

Soils suitable for commercial woodland use make up about 190,000 acres, or 55 percent, of the total survey area. Trees grow on most soils, but commercial conifers grow mostly on specific kinds of soil. The most widespread commercial conifer is ponderosa pine. Other conifers of commercial importance are sugar pine, white fir, incense cedar, and Douglas-fir. Black oak and canyon live oak grow throughout the survey

[2] ROBERT A. DELLBERG, woodland specialist, Soil Conservation Service, assisted in preparing this section.

area in soils suited to commercial conifers and commonly in association with them. Several other noncommercial species of oak, such as interior live oak, blue oak, and valley oak, grow in the Area. Cottonwood, willow, alder, and such hardwoods as bigleaf maple and Oregon ash grow along the streams.

Site quality, which is a measure of productivity of the soil for growing trees, is expressed by a site index. It is determined by measuring the height and deriving the age of the dominant and codominant trees in the stand, and relating this to a standard age of 100 years. In this survey, site quality refers only to ponderosa pine. Conifers on similar soils have about the same relationship in height and age as ponderosa pine. The following site-index ratings are used in this survey: *very high* for a site index of 113 or more; *high* for a site index of 99 to 112; and *moderately high* for a site index of 85 to 98. These indices apply to fully stocked, even-aged, unmanaged stands. The associated yields of wood are shown in the graph (fig. 13).

The soils in the Nevada County Area that are used mostly for wood production have been placed in woodland suitability groups on the basis of soil characteristics that affect the growth of trees. Each group is made up of soils that require similar management and have about the same potential productivity for wood production. The specific soils in each group can be learned by referring to the "Guide to Mapping Units" at the back of this survey. Factors relating to the soils that affect timber production are mentioned in each group. These factors are explained in the following paragraphs.

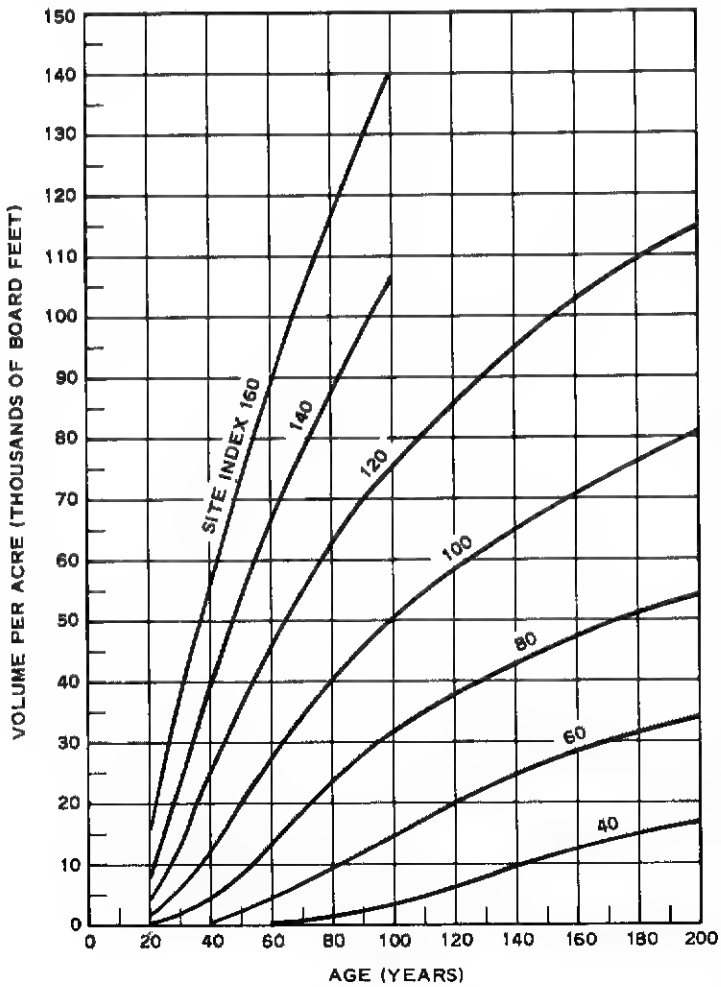

Figure 13.—Per-acre yields of unmanaged ponderosa pine, fully stocked, by various site indexes.

Equipment limitation refers to characteristics of the soils that restrict or prevent the use of equipment commonly employed in tending and harvesting trees. For example, Aiken loam, 2 to 9 percent slopes, has few equipment limitations, except when it is wet. When this soil is wet, which could be six months per year, heavy equipment mires down. Tree-planting machines can be used on this soil, however, at carefully selected times. Steep slopes and large boulders or outcrops of bedrock increase the limitations to use of equipment; sand or gravel decreases the limitation.

Pest and disease hazards are related to many properties and qualities of soils. Depth, texture, and inherent fertility are probably the three most important factors involved. Observations indicate that trees on shallow, rocky soils are most susceptible to pests and diseases.

Windthrow hazard generally is not serious, except on shallow soils derived from slate, shale, schist, or granitic rock.

Limitation for Christmas trees is related to site index, soil characteristics, such textural modifiers as stones or cobblestones, slope, and related factors that affect the rate of growth and quality of young conifers to be cut for Christmas trees. Soils that have a very high site index have a moderate limitation for Christmas-tree growth, because in such soils growth is too rapid. Such growth produces a tree of less than optimum quality because, for Christmas trees, the foliage is relatively sparse compared to the total bulk of the tree; that is, too much space is between the whorls and the branches. Soils where the site index is moderate or lower generally produce a tree of good quality and dense foliage, but growth of these trees is so slow that commercial tree production is unfeasible. Under these conditions, the limitation is severe. Soils where the site index is near the lower end of high or are moderately high have a slight limitation for Christmas trees, because they can produce a good quality tree that has the desired density of foliage in a reasonable length of time.

All the limitations are rated as *slight*, *moderate*, or *severe*. The ratings assigned are based on the best information available and on the judgment of soil scientists, soil conservationists, and woodland conservationists. These ratings may change as more information becomes available.

WOODLAND SUITABILITY GROUP 1

This group consists of soils of the Aiken, Cohasset, Hoda, Horseshoe, Josephine, and Sites series. They have a surface layer of loam or sandy loam. Some of these soils are gravelly or very stony. Depth to bed-

rock is 40 to 60 inches or more. Slopes are 2 to 15 percent. Elevation ranges from 1,500 to 4,500 feet. The average annual precipitation is 40 to 60 inches, and the frost-free season is 135 to 250 days.

Permeability is moderate or moderately slow in the soils of this group. Runoff is slow to medium, and the hazard of erosion is slight to moderate.

These soils have very high site index, moderate equipment limitations, slight pest and disease hazard, and slight windthrow hazard. They have a moderate limitation for growing Christmas trees.

The soils in this group are generally better for timber production than the other forest soils. They are suited to very intensive management. Trees grow rapidly to maturity, and reasonable economic returns can be expected at an early age. Thinning and pruning can be done even after the trees have become fairly large. Seedlings become established fairly easily after logging if a seed source is near. Logging is fairly easy, but in low or level areas equipment is likely to bog down during wet weather. At times there is enough snow to hinder or prevent the use of equipment in places.

Locating and building roads is fairly easy. Except on cobbly and gravelly soils, roads need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads require bridges, ditches, and culverts. Temporary and minor roads should be out-sloped, and grades should be sloped downward toward the watercourse for a short distance on both sides of creeks or draws. Grades should not exceed those considered safe in existing design standards and construction practices. When constructing roads, adequate erosion-control measures are needed.

Fire is relatively easy to control because of easy access and gentle slopes. The soils in areas where trees have been removed by fire or other causes are fairly easy to prepare for planting. Planting can be done by machine.

WOODLAND SUITABILITY GROUP 2

This group consists of soils of the Aiken, Boomer, Cohasset, Hoda, Horseshoe, Josephine, Musick, and Sites series. They have a surface layer of sandy loam to loam. Some of the soils are gravelly, cobbly, or stony. Depth to bedrock is 40 to 60 inches or more. Rock outcrops are common in some areas. Slopes are 2 to 50 percent. Elevation ranges from 1,000 to 4,500 feet. The average annual precipitation is 40 to 60 inches, and the frost-free season is 135 to 250 days.

Permeability is moderate or moderately slow in the soils of this group. Runoff is slow to rapid, and the hazard of erosion is slight to high.

These soils have very high or high site index, moderate to severe but mostly severe equipment limitations, slight to moderate pest and disease hazard, and slight to moderate windthrow hazard. They have a moderate limitation for growing Christmas trees.

The soils in this group are suited to intensive management. Trees grow rapidly, and economic returns can be expected at an early age. Thinning and pruning can be started even after the trees have become fairly large. Seedlings become established easily after logging if a seed source is near, and they grow rapidly to maturity. Logging is more difficult on the soils in this group than on the soils of Group 1 because of steepness. In places logging during wet weather can cause soil compaction. Soil compaction can affect germination and future stand densities. Logging wet soils can cause ruts. The ruts can be the beginning of gullies.

Locating and building roads is fairly difficult. Except on gravelly or cobbly soils, roads need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads need bridges, ditches, and culverts. Temporary and minor roads should be out-sloped, and grades should slope downward toward the watercourse for a short distance on both sides where they cross creeks or draws. Grades should not exceed those considered safe in existing design standards and construction practices. When constructing roads, adequate erosion-control measures are needed.

Fire is difficult to control because of the steep slopes. The soils in areas where trees have been removed by fire or other causes are difficult to prepare for planting. Planting is by machine on gentle slopes where soils are not adversely affected by the use of machinery.

WOODLAND SUITABILITY GROUP 3

This group consists of soils of the Boomer, Cohasset, Hoda, Josephine, and Musick series and areas of Rock outcrop. The soils have a surface layer of sandy loam to loam. Some are gravelly or cobbly. Depth to bedrock is 40 to 60 inches or more. Rock outcrops are present in many areas. Slopes are 5 to 75 percent. Elevation ranges from 1,000 to 4,500 feet. The average annual precipitation is 30 to 58 inches, and the frost-free season is 135 to 260 days.

Permeability is moderate or moderately slow in the soils of this group. Runoff is slow to very rapid, and the hazard of erosion is slight to very high.

These soils have very high or high site index, severe equipment limitations, mostly slight but some moderate pest and disease hazard, and slight to moderate windthrow hazard. They have a moderate limitation for growing Christmas trees.

The soils in this group are excellent forest soils, but because of dominantly steep slopes, they are suited to only moderately intensive management. Trees grow rapidly, and reasonable economic returns can be expected at an early age. Thinning and pruning can be started even after the trees have become fairly large. Seedlings become established fairly easily after logging if a seed source is near. Logging is difficult because of steepness. In places logging during wet weather can cause soil compaction which can affect germination and future stand densities. Logging wet soils can cause ruts. The ruts can be the beginning of gullies.

Locating and building roads is difficult, but most roads do not need to be graveled for year-round use

except in some places. Roads and skid trails should be protected from runoff water. Main roads need bridges, ditches, and culverts. Temporary or minor roads should be out-sloped, and grades should be sloped downward toward the watercourse for a short distance on both sides, where the road crosses creeks or draws. Grades should not exceed those considered safe in existing designs standards and construction practices. When constructing roads, adequate erosion-control measures are needed.

Fire is difficult to control because of steepness of soils. The soils in areas where trees have been removed by fire or other causes are difficult to prepare for planting. Planting is by machine on gentle slopes when the soils are not adversely affected by the use of machinery.

WOODLAND SUITABILITY GROUP 4

The only soil in this group is McCarthy cobbly loam, 5 to 15 percent slopes. It has a surface layer of cobbly loam. Depth to bedrock is 18 to 32 inches. Slopes are 5 to 15 percent. Elevation ranges from 2,800 to 4,600 feet. The average annual precipitation is 48 to 55 inches, and the frost-free season is 145 to 250 days.

Permeability is moderately rapid in this McCarthy soil. Runoff is medium, and the hazard of erosion is slight to moderate.

This soil has high site index, moderate equipment limitations, moderate pest and disease hazard, and moderate windthrow hazard. It has a slight limitation for growing Christmas trees.

The soil in this group is suited to medium intensity management. Tree growth rates are moderate, and economic returns cannot be expected as early as in Groups 1, 2, and 3. Thinning should be done at an early age, and trees should be pruned before they reach a diameter of 15 inches at breast height. Damage from pests can be expected but should not be excessive, except in extremely dry years. Logging is fairly easy, but heavy equipment bogs down in some low or flat areas during wet weather.

Locating and building roads is fairly easy. In some places roads need to be graveled for year-round use. Roads and skid trails should be protected from runoff water. Main roads need bridges, ditches, and culverts. Temporary or minor roads should be out-sloped, and grades should slope downward toward the watercourse for a short distance where they cross creeks and drains. Grades should not exceed those considered safe in existing design standards and construction practices. When constructing roads, adequate erosion-control measures are needed.

Fire is relatively easy to control chiefly because of easy access and gentle slopes. The soil in areas where trees have been removed by fire or other causes is fairly easy to prepare for planting. Planting can be done by machine in most areas where the soils will not be adversely affected by the use of machinery.

WOODLAND SUITABILITY GROUP 5

This group consists of soils of the Boomer, Chaix, Hotaw, Josephine, Mariposa, and McCarthy series and areas of Rock outcrop. The soils have a surface layer of sandy loam to loam. Some of the soils are gravelly or cobbly. Depth to bedrock is 15 to 60 inches or more. Rock outcrops are common in many areas. Slopes are 5 to 50 percent. Elevation ranges from 1,000 to 4,600 feet. The average annual precipitation is 30 to 60 inches, and the frost-free season is 140 to 260 days.

Permeability is moderately rapid to moderately slow in the soils of this group. Runoff is slow to rapid, and the hazard of erosion is moderate to high.

These soils have high site index, mostly severe but some moderate equipment limitations, moderate pest and disease hazard, and slight or moderate windthrow hazard. They have a slight limitation for growing Christmas trees.

The soils in this group are suited to medium intensity management, but management is more difficult than for soils in most other groups, mostly because of steeper slopes. Tree growth rates are moderate, and economic returns cannot be expected as soon as for Groups 1, 2, and 3. Thinning should be done at an early age, and trees should be pruned before they reach a diameter of 15 inches at breast height. Damage from insect pests can be expected on some soils in most years, but it should not be excessive, except in extremely dry years. Logging is more difficult on the soils in this unit than on the soils in Group 4 because of steepness. In places logging during wet weather can cause compaction. Soil compaction can affect germination and future stand densities. Logging wet soils can cause ruts. The ruts can be the beginning of gullies.

Locating and building roads is fairly difficult, but only only on a few soils will roads need to be graveled for year-round use. Roads and skid trails should be protected from runoff. Main roads need bridges, ditches, and culverts. Temporary or minor roads need to be outsloped, and grades need to be sloped downward toward the watercourse for a short distance on both sides where they cross creeks and draws. Grades should not exceed those considered safe in existing design standards and construction practices. Adequate erosion-control measures are needed.

Fire is difficult to control because slopes are steep.

Areas where trees have been removed by fire or other causes can be prepared for planting only with difficulty. If planting is done by machine, the steeper soils should be terraced, and terraces should be slightly out-sloped. Because of cobblestones and rocks in some soils, planting with a planting machine is impractical in places.

WOODLAND SUITABILITY GROUP 6

This group consists of soils of the Chaix, Hoda, Hotaw, Mariposa, and McCarthy series and areas of Rock outcrop. The soils have a surface layer of sandy loam to loam. Some of the soils are cobbly. Depth to bedrock is 15 to 60 inches or more. Rock outcrops are common. Slopes are 15 to 75 percent. Elevation ranges from 1,300 to 4,600 feet. The average annual precipitation is 35 to 60 inches, and the frost-free season is 140 to 250 days.

Permeability is moderately rapid to moderately slow in the soils of this group. Runoff is rapid to very rapid, and the hazard of erosion is high to very high.

These soils have high to moderately high site index, severe equipment limitations, moderate pest and disease hazard, and moderate to severe windthrow hazard. They have a moderate to severe limitation for growing Christmas trees.

The soils in this group are suited to medium intensity management, but management practices are difficult to apply. Tree growth rates are moderate, and economic returns from these soils cannot be expected to be as great or as early as the soils in groups 1, 2, and 3. Thinning should be done at an early age, and trees should be pruned before they reach a diameter of 15 inches at breast height. Damage from pests and disease can be expected but should not be excessive, except during extremely dry years. Logging is difficult and is almost impossible to perform during wet weather. Logging during wet weather can cause compaction. Soil compaction affects germination and future stand densities.

Locating and building roads is difficult, but roads need to be graveled for year-round use only in some places. Roads and skid trails should be protected from runoff water. Main roads need bridges, ditches, and culverts. Temporary and minor roads should be outsloped, and grades should slope downward toward the watercourse for a short distance where they cross creeks or draws. Grades should not exceed those considered safe in existing design standards and construction practices. When constructing roads, adequate erosion control measures are needed.

Fire is difficult to control because of the steep slopes. The soils in areas where trees have been removed by fire or other causes are difficult to prepare for planting. Planting is by machine on the gently sloping soils or when the soils are not adversely affected by use of machinery. Planting by machine is not feasible on cobbly or rocky soils.

WOODLAND SUITABILITY GROUP 7

This group consists of soils of the Chaix, Hotaw, Iron Mountain, and Maymen series and areas of Rock outcrop. The soils have a surface layer of sandy loam or loam. Depth to bedrock is 12 to 40 inches. Rock outcrops are common. Slopes are 2 to 75 percent. Elevation ranges from 1,200 to 4,600 feet. The average annual precipitation is 35 to 55 inches, and the frost-free season is 140 to 230 days.

Permeability is moderately rapid to moderately slow. Runoff is medium to rapid, and the hazard of erosion is moderate to very high.

These soils have moderately high site index, severe equipment limitation, severe insect and disease hazard, and severe windthrow hazard. They have a severe limitation for growing Christmas trees.

The soils in this group are the poorest soils in the survey area for woodland use, and only such extensive management practices as fire protection, pest and disease control, and protection from overgrazing and erosion are generally practical. More intensive measures are warranted in places, however, if they increase value for recreation or as wildlife habitat.

Use of the Soils for Wildlife [3]

This section presents interpretations of soil data relevant to wildlife in the survey area. Such information will be most useful to persons who manage and are concerned with wildlife habitat.

Wildlife is an important, renewable resource in the economy of the Nevada County Area. It provides recreational opportunities for local residents and the general public and produces direct income for many landowners. As the trend toward land development and urbanization increases, a corresponding decrease in amount of wildlife and extent of wildlife habitat is expected. Because space is limited, manipulation of existing habitat and management of cultured habitat is paramount in sustaining wildlife population for harvest and for esthetic value.

Game species of prime importance in the survey area are black-tailed deer, valley quail, mourning dove, and band-tailed pigeon; but in places gray squirrel, brush rabbit, waterfowl, and some bear are also present.

Nongame wildlife are grouped as follows:

Openland nongame wildlife.—Birds and mammals that normally frequent croplands, pastures, lawns, and other areas where grasses and low shrubby growth predominate are meadowlark, field sparrow, blackbird, ground squirrel, rabbit, and skunk.

Brushland and woodland nongame wildlife.—Birds and mammals that normally frequent the oak-grassland, chaparral, orchards, and other areas that have large shrubs and trees are warbler, towhee, thrush, fox, coyote, and bobcat.

Wetland nongame wildlife.—Birds and mammals that normally frequent wet areas, such as ponds, marshes, and creeks, are heron, coot, red-winged blackbird, muskrat, and beaver.

Reservoirs, ponds, and streams provide habitat for various kinds of fish including rainbow trout, brown trout, black bass, and bluegill. These bodies of water also provide habitat for a few wood ducks, mallards, and mudhens. Canada geese use the larger reservoirs during winter. Such bodies of water are well suited to trout production at higher elevations and where the water temperature rarely rises above 70° F. in summer. At lower elevations, warm bodies of water are well suited to bass, bluegill, and channel catfish.

Production of fish in a pond or reservoir is dependent upon the fertility of the water it contains. This in turn is influenced significantly by the fertility of soils in the watershed and, to some extent, by the soil in the pond bottom. Ponds on infertile soils produce less fish per acre. In general, bodies of water in the survey area have a good potential for economic return from fish production and outdoor recreational enterprises that include swimming, boating, camping, picnicking and renting cabin sites.

[3] E. E. ANDREUCCETTI, soil conservationist, Soil Conservation Service, assisted in preparing this section.

Game and nongame species of wildlife require living space which provides food, cover, and water. Such requirements are related to the properties and qualities of the soil. The relationship between soil and wildlife is less direct or obvious than it is between farm, forage, or woodland crops and the soil. Many species of wildlife are insectivorous or carnivorous and feed largely on other organisms which, in turn, feed on plants. The adaptability and quantity of the plants on which wildlife directly or indirectly relies are dependent upon the quality of the soil and the climatic zone.

To show the soil-plant-animal relationship, six wildlife suitability groups have been designated in the Nevada County Area. A suitability group identifies soil properties which have the greatest influence on adaptation and growth of plants. Thus, a given plant species may be adapted and grow well on soils of one suitability, but not on another. This relationship is summarized in table 3. The plants listed in table 3 are of major importance to wildlife in the survey area. They are rated as *well suited* to a soil group if they are naturally abundant, if they grow well under normal methods of propagation, or both. Plants are rated as *moderately suited* to a soil group if they are fairly common, if they require a moderate to high degree of care and management to establish them, or both. Plants are rated *unsuited* or *suitability unknown* if they are not adapted to a soil group or if their adaptability is unknown.

Table 3 also rates plants for particular wildlife species. Plants are rated *well suited* for use in management for a particular species if they provide choice food, choice cover, or both; they are rated as *moderately suited* if they provide fair food, fair cover, or both; and they are rated as *unsuited* or *suitability unknown* if they provide little or no food or cover value or their value is unknown.

WILDLIFE SUITABILITY GROUP 1

This group consists of well-drained soils of the Aiken, Boomer, Cohasset, Hoda, Horseshoe, Josephine, Musick, and Sites series. The surface layer ranges from sandy loam to clay loam and is gravelly or cobbly in places. Depth to bedrock is 40 to 60 inches.

TABLE 3.—*Suitability of selected plants for wildlife suitability groups, wildlife species, and kinds of nongame wildlife*

[A rating of 1 means that the plant is well suited to the wildlife suitability group, wildlife species, or kind of wildlife; 2 means that it is moderately suited; and 3, that it is not suited or that its suitability is unknown]

Plants	Wildlife suitability group—						Wildlife species							Kinds of nongame wildlife		
	1	2	3	4	5	6	Deer	Valley quail	Dove	Band-tail pigeon	Rabbit	Gray squirrel	Water-fowl	Open-land	Brush-land	Wet-land
Alta fescue	1	1	2	3	1	1	1	2	3	3	1	3	2	1	1	1
Atriplex	3	3	3	3	1	2	2	1	2	3	1	3	3	1	2	3
Barley	1	1	3	3	1	1	1	1	2	1	1	2	1	1	2	1
Blackberry	1	2	1	2	1	1	2	1	3	1	1	3	3	2	1	1
Black oak	1	1	3	3	2	3	1	2	2	1	3	1	[1] 3	3	2	3
Blue oak	2	2	3	3	1	2	1	2	2	1	3	1	[1] 2	2	2	3
Buckbrush	1	2	3	3	2	2	1	1	3	2	1	3	3	3	1	3
Burclover	1	2	2	3	1	1	1	1	2	2	1	3	3	1	2	3
California wild rose	1	2	2	3	1	2	2	1	3	2	1	2	3	3	1	2
Coffeeberry	1	2	3	2	2	3	2	2	3	1	2	3	[1] 3	3	2	3
Digger pine	2	2	3	2	1	1	3	2	2	2	3	1	3	3	3	3
Filaree	2	2	3	2	1	1	1	1	1	2	2	3	3	1	3	3
Interior live oak	2	2	3	3	1	2	2	1	1	1	3	1	[1] 3	2	1	2
Lana vetch	1	1	3	2	1	1	1	1	1	2	1	3	2	1	1	3
Manzanita	1	2	3	2	2	2	2	2	3	1	2	3	3	3	1	3
Multiflora rose	2	2	2	3	1	2	2	1	3	3	1	3	3	2	2	2
Narrowleaf trefoil	1	1	1	3	1	1	1	2	1	3	1	3	3	1	2	2
Oats	1	1	3	2	1	1	1	1	2	2	2	3	2	1	2	2
Olive	2	2	3	3	1	1	2	1	2	1	2	3	3	2	1	3
Poison-oak	1	1	2	2	1	1	2	2	3	3	2	3	3	1	1	2
Ponderosa pine	1	2	3	3	2	3	2	2	3	2	3	1	3	3	2	3
Pyracantha	1	2	2	3	1	2	2	1	2	2	1	3	3	2	1	3
Reed canarygrass	2	3	1	2	2	3	2	3	3	3	2	3	3	2	2	1
Ryegrass	1	1	3	2	1	1	1	2	3	3	2	3	2	2	2	2
Scrub oak	2	2	3	3	1	1	1	1	2	1	2	1	3	2	1	3
Soft chess	1	1	3	3	1	1	1	2	3	3	1	1	2	2	2	2
Subterranean clover	1	2	3	3	1	1	1	1	2	3	1	3	3	1	2	3
Sweet birch	1	2	3	2	2	3	1	2	2	3	2	3	3	3	1	3
Toyon	1	2	3	3	2	3	2	1	3	1	2	3	3	2	1	3
Turkeymullein	3	2	3	2	2	1	3	1	1	3	3	3	3	2	3	3
Wheat	2	2	3	2	1	1	1	1	1	1	1	2	1	1	2	2
Willow	2	2	1	3	2	2	1	1	2	3	1	3	3	2	1	1

[1] Wood duck.

Rocks that crop out of the soil and rock fragments are in the profile of soils in many areas. The soils in this group generally are on uplands. Elevation is 1,000 to 4,500 feet. Slopes range from 2 to 75 percent. Vegetation is ponderosa pine and Douglas fir and associated hardwoods, and stand density increases at the higher elevations and in the eastern part of the area where rainfall is greater. Available water holding capacity is 5.5 to 12 inches.

The soils in this group have no limitations to habitat development where slopes are less than 30 percent. Water can be impounded on these soils in areas that have suitable dam sites.

Deer depredation is serious in orchards, pastures, and in the upland game habitat established on these soils. The deer move in from the timberland and brushland around open areas. Deer-proof fencing is the most effective control. Many songbirds frequent areas that have suitable cover.

WILDLIFE SUITABILITY GROUP 2

This group consists of well-drained and somewhat excessively drained soils of the Chaix, Hotaw, Iron Mountain, Mariposa, Maymen, McCarthy, and Secca series, Chaix series, thick solum variant, and areas of Rock outcrop. The surface layer ranges from sandy loam to silt loam and is gravelly, cobbly, or very stony in places. Depth to bedrock is 12 to 60 inches or more. Rocks that crop out of the soil and rock fragments are in the profile of soils in many areas. The soils in this group are on uplands. Elevation is 1,200 to 4,600 feet. Slopes range from 2 to 75 percent. Vegetation is mostly coniferous forest and associated hardwoods and brush. Available water holding capacity is 1 to 8 inches.

The soils in this group have slight to moderate limitations to habitat development where slopes are less than 30 percent and severe limitations where slopes are more than 30 percent. Water can be impounded on most of these soils in areas that have suitable dam sites. These soils are poorly suited to deep-rooted plants.

Because of the large areas of brush that they support, the soils of this group are well suited to browse and cover for deer. Extensive stands of mature brush are not so productive as smaller stands of new brush. Irrigated pastures and other irrigated cropland attract large numbers of deer and need to be protected against depredation. Deer-proof fencing is an effective control. Quail and nongame birds are abundant in areas that have suitable cover and food. Leasing of hunting rights on soils of this group has good potential for economic return to landowners.

WILDLIFE SUITABILITY GROUP 3

This group consists of the well-drained to poorly drained land types Alluvial land, loamy, and Alluvial land, clayey. These land types are in small scattered areas and generally are in swales and on concave positions below seeps and springs. Vegetation is such water-tolerant plants as wire grass, sedge, and cattail.

Because of wetness, these soils generally are a good source of water for wildlife. They provide ideal locations for fish ponds. The drier soils are suitable for such plants as wild blackberry, multiflora rose, and atriplex that provide cover for quail; but care must be taken to prevent uncontrolled spreading of these plants in wet areas.

Deer feed on the green grass and forbs that grow on these soils in summer, and the heavy cover provides nesting habitat for blackbirds and other nongame wildlife.

WILDLIFE SUITABILITY GROUP 4

This group consists mostly of various types of rock land and mined areas and of soils that are very shallow or extremely rocky. It includes areas of Cut and fill land, Rock land, Granitic rock land, Placer diggings, and Tailings and of the well-drained Dubakella soils and Dubakella soils, shallow variant. Depth to bedrock in the Dubakella soils is 14 to 24 inches. The soils in this group are scattered throughout the survey area. Elevation is 1,200 to 4,600 feet. Slopes are 2 to more than 75 percent. Available water holding capacity is 1 to 3 inches. Vegetation is mostly annual grasses, brush, and digger pine. Some areas are barren.

The soils in this group have severe limitations to habitat development. The potential for water impoundment on these soils is extremely variable, depending on position and local conditions, and sites must be investigated individually.

The soils of this group are used as only marginal habitat by deer, quail, dove, and such nongame birds as meadowlark and blackbird.

WILDLIFE SUITABILITY GROUP 5

This group consists of well-drained soils of the Sierra and Trabuco series and areas of Rock outcrop. The surface layer ranges from sandy loam to loam. Rock fragments are present in the profile of these soils, and outcroppings of rock are common in places. Depth to bedrock is 42 to 60 inches or more. These soils are on uplands, generally at 400 to 2,000 feet elevation. Slopes are 2 to 50 percent. Vegetation is oak and grass and scattered ponderosa pine. Available water holding capacity is 6 to 11 inches.

The soils in this group have no limitations to habitat development where slopes are less than 30 percent. Water can be impounded on these soils where suitable dam sites exist.

Deer depredation is serious in orchards, pastures, and the upland game habitat established on these soils. The deer move in from the timberland and brushland around open areas. Deer-proof fencing is the most effective control. Many songbirds frequent areas that have suitable cover.

WILDLIFE SUITABILITY GROUP 6

This group consists of well-drained to somewhat poorly drained soils of the Ahwahnee, Argonaut, Auberry, Auburn, Rescue, Shenandoah, and Sobrante series. The surface layer ranges from sandy loam to loam. Depth to bedrock is 14 to 40 inches. Rocks crop out of the soil and rock fragments are in the profile of soils in many areas. The soils in this group are on uplands. Elevation is 300 to 2,500 feet. Slopes range

from 2 to 50 percent. Vegetation at lower elevations is mostly oak and grass and brush. Available water holding capacity is mostly 2 to 7 inches.

The soils in this group have slight to moderate limitations to habitat improvement where slopes are less than 30 percent and severe limitations where slopes are more than 30 percent. Water can be impounded on most of these soils in areas that have suitable dam sites. These soils are poorly suited to deep-rooted plants. The Auburn, Argonaut, and Shenandoah soils are not suited to conifers.

Because they support large areas of brush, the soils of this group are well suited to habitat management for deer and quail. Extensive stands of mature brush are not so productive as smaller stands of new brush. Irrigated pastures and other irrigated cropland attract large numbers of deer and need to be protected against depredation. Deer-proof fencing is an effective control. Nongame birds are abundant in areas that have suitable cover and food. Leasing of hunting rights on soils of this group has good potential for economic return to landowners.

Engineering Uses of the Soils [4]

This section presents information which is useful to engineers, planners, contractors, and others interested in the engineering properties and qualities of soils. Many soil properties and qualities of interest to the agriculturalist are also of interest to the engineer. Other properties and qualities are of unique interest to the engineer. Users of this survey not familiar with some of the terms used can find many helpful definitions in the Glossary.

Engineers are interested in those properties and qualities that affect the ability of the soil to support various types of structures or that affect its use as a construction material from which structures are built. Included are such structures as roads, buildings, pipelines, channels, dams, and water impoundments. The soil properties and qualities which determine the stability of soil as a building material and those which impose limitations or special requirements for its use in construction include shear strength, compacted permeability, compaction characteristics, shrink-swell behavior, depth to limiting layers, water holding capacity, mechanical analysis, plasticity, piping potential, chemical reaction, slope, and rates of infiltration. Laboratory analyses are needed to determine some of these soil properties and qualities. Laboratory analyses, however, are often limited or are not available for many soils, and it is necessary to estimate their physical and chemical characteristics by comparing such soils to similar soils for which data are available.

A limited number of laboratory soil tests, the results of which are listed in table 4, are the basis for the estimated engineering properties and qualities of the soils discussed in this section and listed in table 5. All references rate a soil to a depth of 5 or 6 feet or to bedrock if it is at a shallower depth.

[4] OLICE T. GERBAZ, civil engineer, Soil Conservation Service, assisted in the preparation of this section.

Table 6 lists engineering interpretations; they are general and not intended to eliminate onsite investigation or sampling and testing of soils for use in the design and construction of specific engineering works. These interpretations are usable in broad planning by engineers, planners, and others. They are also helpful for planning detailed field investigations to determine the behavior of the soil in place at the site of the proposed engineering works.

The information presented in this section can be used to:

1. Make preliminary estimates of the engineering properties of soils for determining the feasibility of irrigation systems, small dams and reservoirs, soil and water conservation structures, and similar works.
2. Make preliminary evaluations of soils that will aid in selecting locations for highways, airports, rural roads, pipelines and cables, and in planning detailed investigations at selected sites.
3. Locate probable sources of borrow material for roadfill and for the construction of dams, dikes, levees, and other embankments.
4. Determine the suitability of soils for cross-country movement of vehicles and construction equipment.
5. Develop other preliminary estimates for construction purposes pertinent to a given area.
6. Supplement the information in other published maps, reports, or aerial photographs to provide data that can be readily used by engineers or others.
7. Correlate performance of engineering structures with individual soils or develop information for general planning that will be useful in designing and maintaining engineering practices and structures.

Engineering classification systems

Two textural classification systems used by engineers, the system approved by the American Association of State Highway Officials and the Unified system, are used in tables 4 and 5. The engineering classification system of the American Association of State Highway Officials (AASHO) (*1*) is based on field performance of highways. In this system soil materials are classified in seven main groups. The groups range from A–1, which consists of gravelly soils of high shear strength, the best soils for subgrade, to A–7, which consists of clayey soils that have low shear strength when wet, the poorest soils for subgrade. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The estimated AASHO classifications for all the soils in the survey area are given in table 5. The AASHO classifications, with group index numbers in parentheses, based on laboratory test data are given in table 4.

The Unified classification system (*15*) identifies soils according to their grain-size distribution and

TABLE 4.—*Engineering*

[Tests performed by District III, California Division of Highways, in accordance with

Soil name and location	Parent material	Report No.	Depth	Moisture-density data [1]		Mechanical analyses [2]			
						Percentage passing sieve—			
				Maximum dry density	Optimum moisture	2 inch	1½ inch	1 inch	¾ inch
			Inches	*Pounds per cubic foot*	*Percent*				
Ahwahnee sandy loam:									
1,000 feet S. and 900 feet E. of NW. corner of sec. 1, T. 14 N., R. 7 E., 9½ miles SSW. of Grass Valley. (Modal)	Granodiorite.	67–1237	0–2	119	10	-------	-------	100	99
		67–1238	16–33	126	12	-------	-------	-------	-------
Boomer loam:									
500 feet E. and 400 feet S. of center of sec. 4, T. 15 N., R. 7 E., ¾ mile W. of Indian Springs. (Modal)	Diabase (greenstone).	67–1234	0–6	120	14	-------	-------	100	99
		67–1235	18–29	125	14	100	98	95	94
		67–1236	37–47	122	14	-------	-------	-------	100
Chaix sandy loam:									
1,250 feet W. and 100 feet N. of SE. corner of sec. 28, T. 18 N., R. 8 E., Mount Diablo base line and meridian. (Modal)	Granodiorite.	69–0052	3–8	120	11	-------	-------	-------	-------
		69–0053	8–24	127	10	-------	-------	-------	-------
		69–0054	24–34	123	11	-------	-------	-------	-------
Cohasset cobbly loam:									
650 feet E. of NW. corner of sec. 21, T. 17 N., R. 9 E. (Thinner solum than modal)	Basic intrusive rock.	67–1231	2–7	116	20	-------	-------	-------	100
		67–1232	26–32	119	19	-------	100	99	97
		67–1233	55–65	121	14	-------	-------	100	99
Hoda sandy loam:									
800 feet W. and 500 feet S. of E. ¼ corner of sec. 30, T. 17 N., R. 9 E., Mount Diablo base line and meridian, 3 miles NNE. of Nevada City. (Modal)	Granodiorite, coarse grained.	69–0076	0–12	118	13	-------	-------	-------	-------
		69–0077	18–46	105	22	-------	-------	-------	-------
		69–0078	53–59	108	19	-------	-------	-------	-------
Horseshoe gravelly loam:									
1,320 feet W. and 300 feet N. of E. ¼ corner of sec. 7, T. 17 N., R. 9 E., Mount Diablo base line and meridian. (Modal)	Mixed alluvium, Tertiary gravels.	69–0049	2–10	109	17	100	99	99	97
		69–0050	32–43	116	16	-------	100	99	96
		69–0051	59–69	133	9	-------	100	99	97
Josephine loam:									
660 feet W. and 660 feet N. of E. ¼ corner of sec. 18, T. 17 N., R. 9 E., Mount Diablo base line and meridian. (More gravel in surface layer than in modal)	Soft shales, Calaveras formation.	69–0055	3–8	108	17	-------	100	99	99
		69–0056	36–48	104	19	-------	-------	-------	100
		69–0057	62–72	97	25	-------	-------	-------	-------
Mariposa gravelly loam:									
1,600 feet S. and 100 feet E. of N. ¼ corner of sec. 9, T. 17 N., R. 9 E., Mount Diablo base line and meridian, 1½ miles SSE. of North Columbia. (Profile not as deep as modal)	Shattered soft slates, Calaveras formation.	69–0061	4–10	98	18	100	99	98	95
		69–0062	10–21	120	13	100	98	89	85
Musick sandy loam:									
800 feet W. and 250 feet S. of E. ¼ corner of sec. 2, T. 17 N., R. 8 E., Mount Diablo base line and meridian. (Modal)	Granodiorite, coarse grained.	69–0064	4–19	114	13	100	99	.99	99
		69–0065	60–69	111	17	-------	-------	-------	-------
Rescue loam:									
950 feet E. and 350 feet S. of NW. corner of sec. 23, T. 14 N., R. 8 E., Mount Diablo base line and meridian, 11 miles S. of Grass Valley. (Modal)	Diabase or meta-basic rock.	69–0067	3–9	113	15	-------	-------	-------	100
		69 0068	19–33	120	14	100	97	97	97
		69–0069	33–50	120	13	100	99	98	97

See footnotes at end of table.

test data

standard procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analyses [2]—Continued										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued						Percentage smaller than—							
⅜ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.) [3]	No. 40 (0.42 mm.) [3]	No. 60 (0.25 mm.) [3]	No. 200 (0.074 mm.)	0.05 mm.[3]	0.02 mm.[3]	0.005 mm.	0.002 mm.[3]			AASHO [4]	Unified [5]
										Percent			
99	98	94	68	59	41	39	30	16	10	32	8	A-4(2)	SM
-------	100	97	74	63	43	41	35	23	20	31	13	A-6(3)	SC
94	88	83	78	76	68	61	36	20	12	32	5	A-4(5)	ML
89	85	80	74	71	62	59	45	22	17	26	6	A-4(3)	ML-CL
97	91	82	72	67	53	48	33	12	8	29	3	A-4(3)	ML
-------	100	90	67	60	42	40	30	15	10	-------	[6] NP	A-4(0)	SM
-------	100	92	71	63	45	42	33	20	17	28	5	A-4(2)	SM-SC
-------	100	93	68	60	39	38	28	17	13	34	5	A-4(1)	SM
97	87	76	60	56	48	43	33	17	11	44	8	A-5(3)	SM
93	85	76	62	58	48	44	36	21	13	29	4	A-4(2)	SM
98	95	87	71	65	48	44	33	18	12	26	3	A-4(2)	SM
-------	100	96	70	63	45	42	33	19	12	30	7	A-4(2)	SM-SC
-------	100	97	84	80	69	65	58	46	40	53	23	A-7(17)	MH
-------	100	94	73	66	50	47	38	27	21	-------	NP	A-4(2)	SM
94	90	86	65	56	41	39	30	18	11	30	4	A-4(1)	SM
90	86	83	70	65	56	52	45	33	27	47	18	A-7(9)	ML
88	73	64	41	33	26	24	20	15	12	45	16	A-2(1)	SM
98	93	86	74	71	66	60	46	24	14	34	9	A-4(5)	ML
99	99	96	94	92	90	85	70	49	40	51	23	A-7(25)	CH-MH
-------	-------	100	99	98	94	90	75	53	43	65	28	A-7(34)	MH
88	77	66	51	48	42	40	34	23	12	35	5	A-4(2)	SM
77	66	57	44	42	35	33	29	21	13	31	7	A-2(0)	GM
99	98	96	80	72	52	50	39	22	14	30	5	A-4(3)	ML
-------	100	98	80	71	52	50	44	33	30	47	27	A-7(12)	CL
98	93	87	72	67	57	53	41	25	12	32	5	A-4(4)	ML
97	93	86	70	65	53	49	40	25	17	28	8	A-4(3)	CL
95	95	76	52	47	37	34	27	17	11	31	7	A 4(1)	SM

TABLE 4.—*Engineering*

Soil name and location	Parent material	Report No.	Depth	Moisture-density data [1]		Mechanical analyses [2]			
						Percentage passing sieve—			
				Maximum dry density	Optimum moisture	2 inch	1½ inch	1 inch	¾ inch
Secca gravelly silt loam:									
300 yards N. of SW. corner of SE. ¼ corner of sec. 4, T. 15 N., R. 8 E., 4 miles SW. of Grass Valley. (Gravelly loam surface layer, A horizon thinner than modal)	Amphibolite and meta-basic rock similar to to diabase.	69 0058	0–3	131	10	------	100	98	97
		69–0059	9–37	117	13	------	------	------	100
Sobrante loam:									
1,100 feet W. and 1,050 feet S. of N. ¼ corner of sec. 23, T. 14 N., R. 7 E. (Modal)	Diabase.	67–1244	0–3	116	15	------	------	100	99
		67–1254	19–27	121	12	------	100	99	99
Trabuco loam:									
600 feet N. of N. ¼ corner of sec. 9, T. 16 N., R. 7 E., Mount Diablo base line and meridian 8½ miles NW. of Grass Valley. (Modal)	Granodiorite, coarse grained.	69–0070	0–10	118	13	------	------	------	------
		69–0071	15–40	107	17	------	------	------	------
		69–0072	55–67	110	17	------	------	------	------

[1] Based on the method of test for relative compaction of untreated and treated soils and aggregates, Test Method No. California 216E.
[2] Mechanical analyses by the California Division of Highways. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the California procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

plasticity and groups them according to their performance as engineering construction material. In this system GP and GW and SP and SW are clean gravels and sands. GM and GC and SM and SC are gravels and sands that have a considerable amount of nonplastic and plastic fines, respectively. ML and CL are nonplastic and plastic fine materials that have a low liquid limit, and MH and CH are nonplastic and plastic, fine-textured soils that have a high liquid limit. Organic soils and peat are designated by the symbols OL, OH, and Pt. A joint classification symbol, such as ML–CL, is used on soils that have characteristics bordering on two groups.

The estimated classification for all soils in this survey area according to the Unified classification system is given in table 5. The Unified classes, based on laboratory test data, are given in table 4.

Engineering test data

Selected horizons from 13 soils in the Nevada County Area were tested in the laboratory to help evaluate the soil properties significant to engineering (*6*). Results of these tests are shown in table 4, "Engineering Test Data." The table also includes the soil name and the location and depth at which the sample was taken.

Mechanical analysis indicates how the size and proportions of soil particles affect the behavior of soils for various engineering uses. The California Division of Highways uses the sieve and hydrometer method in determining the mechanical analysis.

In the moisture-density or compaction test, a sample of the soil material is compacted several times using a constant compactive effort, but each time at a higher content of moisture. The density of the compacted soil increases as the moisture content increases until the optimum moisture content is reached; beyond this point, density decreases with an increase in moisture content. Maximum dry density and associated optimum moisture are thus determined.

Liquid limit and plasticity index (Atterberg limits) are tests to determine the plastic limit and liquid limit. They measure the effect of water on consistence of the soil. As the moisture content of a plastic (clayey) soil increases from a dry state, the soil changes from a semisolid to a plastic. As the moisture content is further increased, the material changes from a plastic to a liquid. The plastic limit is the moisture content at which the material passes from a semisolid state to a plastic state. The liquid limit is the moisture content at which the soil passes from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range in moisture content within which the soil is in a plastic condition. Moisture content, limits, and index are expressed as per-

test data—Continued

Mechanical analyses [2]—Continued										Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Contined						Percentage smaller than—							
⅜ inch	No. 4 (4.7 mm.)	No. 10 (2.0 mm.) [3]	No. 40 (0.42 mm.) [3]	No. 60 (0.25 mm.) [3]	No. 200 (0.074 mm.)	0.05 mm.[3]	0.02 mm.[3]	0.005 mm.	0.002 mm.[3]			AASHO [4]	Unified [5]
89	79	74	64	59	51	47	35	18	10	26	7	A–4(3)	ML–CL
99	99	99	97	95	84	80	70	55	44	57	37	A–7(33)	CH
93	86	79	69	65	56	52	41	25	14	38	8	A–4(4)	ML
96	93	85	72	67	55	52	41	25	16	27	6	A–4(3)	ML–CL
--------	100	99	89	83	62	59	46	28	19	32	9	A–4(4)	ML–CL
--------	--------	100	95	91	77	72	61	46	35	48	23	A–7(16)	CL
--------	--------	100	91	85	67	63	52	35	27	41	17	A–7(11)	CL

[3] Percentage of material passing sieves no. 10, 40, and 60, and percentage smaller than 0.05 millimeters, 0.02 millimeters, and 0.002 millimeters were obtained by interpolation of data from the California Division of Highways.
[4] Based on American Association of State Highway Officials Designation: M 145–49 (*1*).
[5] Based on the Unified Soil Classification System (*15*).
[6] NP — Nonplastic.

cent of dry weight of the soil but are not applicable to predominantely gravelly or sandy soils.

Estimated soil properties significant to engineering

Table 5 estimates the properties significant to engineering. This table also lists the soil series name and map symbol, depth to bedrock, depth from surface of the typical profile, and the USDA texture and estimated Unified and AASHO classifications. The estimated mechanical analysis, Atterberg values, permeability, available water holding capacity, and reaction are given. These estimates are based on the test results in table 4, field examination, and experiences with soils in the Area and similar soils from other areas. As these estimates are for the typical soils, some variations from the values given should be expected. A more detailed explanation of some of the properties estimated in table 5 is included in the paragraphs that follow.

Depth to bedrock, expressed in feet, gives the observed or estimated range of depth from the surface to bedrock.

According to the system used by soil scientists of the U.S. Department of Agriculture, the basic textural class name is based on the size distribution of the material smaller than 2.0 millimeters in diameter. The material smaller than 2.0 millimeters in diameter is classified into three size fractions—sand, silt, and clay. The percentage of the three size fractions determines the textural classification.

The columns headed "Percentage passing sieve" show the estimated range in percentage of material passing sieves numbered 4, 10, 40, and 200. It should not be assumed that all samples of a specific soil will fall within the range of the typical profile shown or that the engineering classification will be the same as shown. The range of estimated physical properties is broad for some soils, and as a result the soils may be in several classification groups.

Soil permeability is the ability of a soil to transmit air or water. The rates given in table 5 are for the soils as they occur in place.

The available water holding capacity, expressed in inches per inch of soil depth, is the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between amount of soil water at field capacity and the amount at wilting point.

Reaction as shown in table 5 is the estimated range in pH values for each major horizon as determined in the field. It indicates the acidity or alkalinity of the soil. A notation of pH 7.0, for example, is neutral. A lower value indicates acidity, and a higher value indicates alkalinity.

Engineering interpretations

Table 6 gives the hydrologic soil group and rates the soils according to their suitability as a source of topsoil and roadfill. It also lists those soil features that affect road location, water-retention structures, and ir-

TABLE 5.—*Estimated soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that appear in the first column of this table. The

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Ahwahnee: AdB, AdC, AdD, AeD, AeE Rock outcrop parts of AeD and AeE are too variable for valid estimates.	2½–3½	0–38 38	Sandy loam and heavy sandy loam. Granodiorite.	SM–SC or SC	A–4 or A–6
Aiken: AfB, AfC, AfD, AfE, AgD, AgE In AgD and AgE percentage of material greater than 3 inches ranges from 15 to 50 percent.	4–5	0–29 29–64 64	Loam Heavy clay loam Andesitic tuff and conglomerate.	ML ML or MH	A–5 A–7
Alluvial land, clayey: Ao. Too variable for valid estimates.					
Alluvial land, loamy: Am. Too variable for valid estimates.					
Argonaut: ArC, AsD	1½–3	0–10	Gravelly loam	SM or SM–SC	A–4
Rock outcrop part of AsD is too variable for valid estimates.		10–28 28	Gravelly clay and gravelly clay loam. Weathered diabase.	CH–MH	A–7
Auberry: AtC, AuD, AuE Rock outcrop parts of AuD and AuE are too variable for valid estimates.	3–4	0–14 14–27 27–40 40	Sandy loam Heavy sandy loam and sandy clay loam. Sandy loam Granodiorite.	SM SC SM	A–4 A–6 A–4
*Auburn: AvD, AwC, AxD, AxE For Argonaut part of AwC, see Argonaut series. Rock outcrop parts of AxD and AxE are too variable for valid estimates.	1–2	0–16 16	Heavy loam and light clay loam. Metabasic rock.	CL–ML or CL	A–4 or A–6
Boomer: BoC, BoD, BrD, BrE Rock outcrop parts of BrD and BrE are too variable for valid estimates.	3½–5+	0–47 47	Loam and clay loam Diabase.	CL or ML	A–4
*Chaix: CdE2, ChC2, ChD2, ChE2, CkF For Hotaw parts of ChC2, ChD2, and ChE2, see Hotaw series. Rock outcrop part of CkF is too variable for valid estimates.	1½–3½	0–34 34	Sandy loam and heavy sandy loam. Granodiorite.	SM	A–4
Chaix, thick solum variant: ClC, ClD, ClE	2–4	0–17 17–34 34–44 44	Loam (very stony surface layer). Clay loam Sandy loam Gabbrodiorite.	ML CL–ML or CL SM	A–4 A–4 or A–6 A–2
*Cohasset: CmB, CmC, CmD, CoD, CoE, CsE, CsF For McCarthy part of CsE and CsF, see McCarthy series.	3½–5+	0–96 96	Cobbly loam and cobbly clay loam. Andesitic conglomerate.	SM–SC or ML–CL	A–4 or A–5
Cut and fill land: Ct. Too variable for valid estimates.					
Dubakella Mapped only in complex with Rock outcrop, which is too variable for valid estimates.	1½–2	0–21 21	Gravelly clay loam and very cobbly clay. Ultrabasic rock.	SC or GC	A–2 or A–6
Dubakella, shallow variant: DrE Rock outcrop part is too variable for valid estimates.	1–1½	0–18 18	Heavy loam and heavy clay loam. Serpentine.	CL	A–6
Granitic rock land: Gr. Too variable for valid estimates.					

properties significant in engineering

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for symbol > means more than; the symbol < means less than. NP = Nonplastic]

Percentage greater than 3 inches	Percentage less than 3 inches passing sieve—				Atterberg values		Permeability	Available water holding capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index			
					Percent		*Inches per hour*	*Inches per inch of soil*	*pH*
0–5	95–100	90–100	65–80	35–50	25–35	5–15	2.0–6.0	0.12–0.14	5.1–6.5
0–15	100	95–100	75–85	50–60	40–50	NP–10	0.6–2.0	0.15–0.17	5.6–6.5
0–15	100	95–100	90–95	70–80	45–55	15–25	0.2–0.6	0.17–0.19	4.5–6.0
0–5	75–95	60–90	60–80	35–50	10–20	NP–10	0.6–2.0	0.11–0.13	5.6–6.5
0–5	75–95	75–90	60–85	55–75	50–60	20–35	<0.06	0.08–0.10	6.1–7.3
0–20	95–100	90–100	65–75	35–45	20–35	NP–5	2.0–6.0	0.11–0.13	5.6–6.5
0–20	100	90–100	70–80	40–50	30–40	10–20	0.6–2.0	0.15–0.17	5.6–6.5
0–20	95–100	90–100	65–75	35–45	10–20	NP–5	2.0–6.0	0.11–0.13	6.1–6.5
0	70–95	65–90	60–80	50–65	25–40	5–15	0.6–2.0	0.15–0.19	6.1–6.5
0–25	85–100	80–95	70–80	50–70	25–35	5–10	0.2–0.6	0.15–0.17	5.6–6.5
0–5	100	90–100	65–75	35–50	20–35	NP–5	2.0–6.0	0.13–0.15	5.1–6.5
0–10	95–100	85–95	65–75	50–60	25–35	NP–5	0.6–2.0	0.12–0.14	5.6–6.5
0–10	95–100	85–95	75–85	60–70	25–35	5–15	0.2–0.6	0.17–0.19	5.6–6.0
0–10	95–100	85–95	60–70	25–35	20–30	0–5	2.0–6.0	0.10–0.12	5.6–6.0
0–55	80–90	75–90	60–75	40–60	25–45	5–10	0.2–0.6	0.11–0.17	5.1–6.5
20–65	50–90	35–80	30 50	20–45	30 40	10 20	0.06–0.2	0.12 0.14	5.6–7.3
0	90 100	85–100	75–90	50 65	30–40	10–25	<0.06	0.08–0.10	5.6–7.8

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
Hoda: HnB, HnC, HnE, HoC2, HpF Rock outcrop part of HpF is too variable for valid estimates.	>5	0–18 18–46 46–63	Sandy loam and loam Clay Sandy clay loam	SM MH or CH SM—SC	A–4 A–7 A–4
Horseshoe: HrC, HrD	>5	0–10 10–50 50–69	Gravelly loam Gravelly clay loam Very gravelly loam and stratified sands and gravel.	SM or SC ML SM or GM	A–4 A–7 A–2 or A–1
Hotaw Mapped only in complex with Chaix soils.	2–3½	0–21 21–34 34	Sandy loam Sandy clay loam Granodiorite.	SM SC	A–2 or A–4 A–6
Iron Mountain: ImE	1–2	0–17 17	Loam and cobbly loam Andesitic conglomerate.	SM	A–2
*Josephine: JoC, JoD, JoE, JpD, JrE2, JrF2, JsE For Mariposa parts of JrE2 and JrF2, see Mariposa series. Rock outcrop part of JsE is too variable for valid estimates. In JpD percentage of material greater than 3 inches ranges from 30 to 35 percent.	3½–5+	0–18 18–70 70	Loam and gravelly loam Silty clay loam Slates and shales.	GM or ML CH or MH	A–4 A–7
*Mariposa: MaD, McF2, MkE For Maymen part of McF2, see Maymen series. Rock outcrop part of MkE is too variable for valid estimates.	1½–2½	0–20 20	Gravelly heavy loam and gravelly clay loam. Metasedimentary rock.	SM or GM	A–2 or A–4
*Maymen: MmE2 For Mariposa part, see Mariposa series.	1–1½	0–17 17	Gravelly loam Slate.	SM or GM	A–4
McCarthy: MnE	1½–2½	0–20 20	Sandy loam and fine sandy loam. Rhyolitic tuff.	SM or ML	A–4
MoC, MoE	1½–2½	0–31 31	Cobbly and very cobbly loam. Andesitic conglomerate.	SM–SC	A–4
Musick: MrC, MrE, MsE Rock outcrop part of MsE is too variable for valid estimates.	3½–5+	0–25 25–80	Sandy loam and loam Clay loam and heavy clay loam.	ML or SM CL	A–4 A–7
Placer diggings: Pr. Too variable for valid estimates.					
Rescue: RkD Rock outcrop part is too variable for valid estimates.	3½–5+	0–33 33–50 50	Loam and clay loam Heavy loam Diabase.	CL–ML or CL SM	A–4 or A–6 A–4
Rock land: Rn. Too variable for valid estimates.					
Rock outcrop: RoE, RpD, RrE. Too variable for valid estimates. For Ahwahnee part of RoE, see Ahwahnee series. For Auburn part of RpD, see Auburn series. For Dubakella part of RrE, see Dubakella series.					
Secca: ScE Rock outcrop part is too variable for valid estimates.	3½–5+	0–15 15–45 45	Gravelly silt loam Cobbly and gravelly clay Metabasic rock.	ML or GM CH	A–4 A–7

significant in engineering—Continued

Percentage greater than 3 inches	Percentage less than 3 inches passing sieve—				Atterberg values		Permeability	Available water holding capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index			
0–45	95–100	90–100	60–70	40–50	25–35	NP–10	2.0–6.0	0.13–0.15	5.1–6.5
0–15	95–100	90–100	75–85	65–75	50–60	20–30	0.2–0.6	0.14–0.16	4.5–5.5
0–15	95–100	85–95	65–75	40–50	20–30	5–10	0.6–2.0	0.14–0.16	4.5–5.5
0	80–100	70–95	50–70	35–50	25–35	NP–5	0.6–2.0	0.13–0.15	5.1–6.5
0	85–100	70–95	60–80	50–65	40–50	10–20	0.6–2.0	0.15–0.17	4.5–5.5
0	50–75	35–65	30–45	20–35	20–30	NP–5	0.6–2.0	0.08–0.10	4.5–5.0
0–5	100	90–100	65–75	30–40	20–30	NP–5	2.0–6.0	0.10–0.12	5.6–6.5
0–5	100	90–100	70–80	35–45	25–35	10–20	0.2–0.6	0.14–0.16	5.1–6.0
20–45	75–95	65–85	45–65	25–35	20–30	NP–5	2.0–6.0	0.08–0.10	5.6–6.5
0	60–100	50–80	45–75	40–70	30–40	NP–10	0.6–2.0	0.11–0.15	5.6–6.5
0	95–100	95–100	90–100	85–95	50–65	20–35	0.6–2.0	0.14–0.20	5.1–6.0
0	60–90	50–85	40–60	30–45	30–40	NP–10	0.6–2.0	0.13–0.15	4.5–6.5
0	60–95	50–90	45–70	35–50	10–20	NP–5	0.6–2.0	0.12–0.14	5.6–6.5
0	100	90–100	70–85	40–55	20–30	NP–5	2.0–6.0	0.13–0.15	5.6–6.5
35–65	70–80	65–75	55–70	35–50	20–30	5–10	0.6–2.0	0.10–0.12	5.6–6.5
0–5	90–100	90–100	75–85	40–60	25–35	NP–5	0.6–2.0	0.13–0.15	5.6–6.5
0–5	95–100	90–100	75–85	50–65	40–50	20–30	0.2–0.6	0.19–0.21	5.1–6.0
0	90–100	85–95	70–80	50–60	25–35	5–15	0.2–0.6	0.17–0.19	5.6–6.5
0	90–100	70–80	50–60	35–45	25–35	NP–10	0.2–0.6	0.12–0.14	5.6–6.5
0–50	60–80	55–75	50–70	45–55	25–35	NP–10	0.2–0.6	0.13–0.15	5.6–6.5
5–50	85–100	75–95	60–80	55–70	50–60	30–40	0.06–0.2	0.09–0.11	6.1–7.8

TABLE 5.—*Estimated soil properties*

Soil series and map symbols	Depth to bedrock	Depth from surface of typical profile	Classification		
			USDA texture	Unified	AASHO
Shenandoah: SdC	2–3½	0–18	Sandy loam	SM	A–2
		18–27	Clay	CH	A–7
		27–36	Coarse sandy loam	SM	A–1 or A–2
		36	Granodiorite.		
Sierra: SfB, SfC, SfD, SkD, SkE	3½–5+	0–16	Sandy loam	SM	A–2
Rock outcrop parts of SkD and SkE are too variable for valid estimates.		16–45	Sandy clay loam	SM	A–4 or A–2
		45	Granodiorite.		
Sites: SlB, SlC, SlD, SmC, SmE	3½–5+	0–23	Heavy loam and clay loam.	ML	A–5 or A–7
In SmC and SmE percentage of material greater than 3 inches ranges from 0 to 40 percent.		23–68	Clay	MH	A–7
		68	Metasedimentary rock.		
Sobrante: SoC, SoD, SrD, SrE	2–3	0–27	Loam and light clay loam	ML	A–4 or A–6
Rock outcrop parts of SrD and SrE are too variable for valid estimates.		27	Diabase		
Tailings: Ta.					
Too variable for valid estimates.					
Trabuco: TrC, TuD, TuE	3½–5+	0–15	Heavy loam	ML	A–4 or A–6
Rock outcrop parts of TuD and TuE are too variable for valid estimates.		15–67	Clay and clay loam	CL	A–7
		67	Granite.		

rigation. These features are important for the construction, operation, or maintenance of the structure or practice indicated.

Hydrologic soil groups are used for estimating the runoff potential of soils. Groupings are based on potential runoff at the end of a long storm and after prior wetting and opportunity for swelling. The absence of a protective vegetative cover is assumed. Four groupings are used, A, B, C, and D. Group A has the least runoff and highest infiltration potential, and Group D the highest runoff and lowest infiltration potential. Groups B and C are intermediate. Hydrologic soil groups are based on such soil properties as soil texture, the presence of restrictive layers, depth, subsoil permeability, and natural drainage class.

The suitability rating as a source of topsoil is for use of a soil on side slopes, shoulders of roads, areas along waterways, and on lawns or golf courses or similar areas. The ratings of *good, fair,* and *poor* reflect suitability for the growth of vegetation and are based on such soil features as texture, presence of gravel or stones, salinity, reaction, inherent fertility, thickness, slope, and natural drainage class of the source material.

Soils are rated on the basis of their suitability as a source of road fill if moved from borrow areas for use as fill for road subgrade material. Accessibility of source material is not considered. Suitability ratings of *good, fair,* and *poor* are based on the AASHO classification system.

Soil features affecting the location of roads are discussed. They include soil depth, slope, rockiness or stoniness, and shrink-swell potential. Where excavations of more than 5 feet are anticipated, onsite geologic exploration is recommended.

Various soil features affect the construction of such water-retention structures as irrigation reservoirs, fish ponds, stockwater ponds, recreation lakes, and sewage lagoons. Two separate functions are rated, one for use of soil as a floor for impoundment areas and one for use of soil as a source of embankment material. Soil properties considered for the floor of an impoundment area include presence of rock outcrops, permeability, slope, and depth to bedrock. Soil properties considered for an embankment include strength, susceptibility to piping, and compacted permeability. Onsite investigations are necessary to determine the type, amount, and availability of borrow materials, and to obtain data for design.

Soil features pertinent to design and management of irrigation systems include basic intake rate of the soil, available water holding capacity, depth to restrictive layers, slope, and permeability. The quantity and quality of irrigation water available are not considered here, but these must be determined before designing any irrigation system.

Use of the Soils for Community Development

This section describes and lists interpretations of the soils of the Nevada County Area for residential, recreational, industrial, and related nonfarm purposes. It was prepared for people interested in use of the soils of the Nevada County Area for purposes other than farming (fig. 14), but is most useful to planners, developers, landscape architects, builders, zoning officials, realtors, and private and potential landowners.

The Nevada County Area is close enough to large population centers, such as Sacramento and the San

significant in engineering—Continued

Percentage greater than 3 inches	Percentage less than 3 inches passing sieve				Atterberg values		Permeability	Available water holding capacity	Reaction
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	Liquid limit	Plasticity index			
0-5	95-100	85-95	50-60	25-35	25-35	NP-10	2.0-6.0	0.11-0.13	5.6-6.5
0-5	95-100	90-100	70-80	55-65	50-60	30-40	<0.06	0.10-0.12	5.6-6.5
0-5	90-100	85-95	40-50	20-30	20-30	NP	0.2-0.6	0.10-0.12	6.1-7.3
0	100	90-100	65-75	25-35	25-35	NP-10	0.6-2.0	0.11-0.13	6.1-6.5
0	100	90-100	65-75	35-45	30-40	NP-10	0.2-0.6	0.14-0.16	5.6-6.5
0	65-100	60-90	55-85	50-70	40-50	5-15	0.6-2.0	0.16-0.18	5.6-6.5
0	65-100	60-100	55-85	50-80	50-60	15-25	0.2-0.6	0.15-0.17	4.5-6.0
0	85-95	65-85	60-75	50-60	30-40	5-15	0.6-2.0	0.17-0.19	5.6-6.5
0	95-100	85-100	80-90	60-70	30-40	5-15	0.6-2.0	0.14-0.16	5.1-6.5
0	95-100	85-100	80-95	65-80	40-50	15-25	0.06-0.2	0.17-0.19	5.6-7.3

Figure 14.—Homesites and golf course on Sites loam.

Francisco Bay Area, so that greater demands for nonfarm uses are being made. Although the population is not growing rapidly, areas set aside for nonfarm uses are expanding into sections previously used wholly for grazing and timber production. This trend has resulted in requests for information about soil and land conditions that affect the nonfarm use of the land.

In selecting a location for a home, industry, highway route, recreational use, or other nonfarming purpose, the limitations of the soil at each site for the prospective use must be determined. Some of the more common properties and qualities affecting the nonfarm use of soils are soil texture, reaction, depth, shrink-swell potential, steepness of slope, permeability, and depth to hard rock. On the basis of these interrelated characteristics, soil scientists and engineers have rated the soils of the Nevada County Area for specific nonfarm uses. The most urgent needs are for information about the limitation of soils for the disposal of sewage effluent from septic tanks and as sites for

TABLE 6.—*Interpretations of soil*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such to other series that appear in the

Soil series and map symbols	Hydrologic soil group	Suitability as source of—	
		Topsoil	Road fill
Ahwahnee: AdB, AdC, AdD, AeD, AeE. Rock outcrop parts of AeD and AeE are too variable for valid interpretation.	C	Good in AdB. Fair in AdC: slope. Poor in AdD, AeD, and AeE: slope; rock outcrops.	Fair to poor: A–4 or A–6 material.
Aiken: AfB, AfC, AfD, AfE, AgD, AgE	B	Good in AfB. Fair in AfC: slope. Poor in AfD, AfE, AgD, and AgE: slope; cobblestones.	Fair to poor: A–4, A–5 or A–7 material.
Alluvial land, clayey: Ao. Too variable for valid interpretation.			
Alluvial land, loamy: Am. Too variable for valid interpretation.			
Argonaut: ArC, AsD. Rock outcrop part of AsD is too variable for valid interpretation.	D	Poor: gravelly; slope.	Fair to poor: A–4 or A–7 material.
Auberry: AtC, AuD, AuE. Rock outcrop parts of AuD and AuE are too variable for valid interpretation.	B	Poor: slope	Fair to poor: A–4 or A–6 material.
*Auburn: AvD, AwC, AxD, AxE. For Argonaut part of AwC, see Argonaut series. Rock outcrop parts of AxD and AxE are too variable for valid interpretation.	D	Poor: bedrock at depth of 1 to 2 feet.	Fair to poor: A–4 or A–6 material.
Boomer: BoC, BoD, BrD, BrE. Rock outcrop parts of BrD and BrE are too variable for valid interpretation.	B	Fair in BoC: slope. Poor in BoD, BrD, and BrE: slope; rock outcrops.	Fair: A–4 material
*Chaix: CdE2, ChC2, ChD2, ChE2, CkF. For Hotaw parts of ChC2, ChD2, and ChE2, see Hotaw series. Rock outcrop part of CkF is too variable for valid interpretation.	C	Fair in ChC2: slope. Poor in CdE2, ChD2, ChE2, and CkF: slope; cobblestones; rock outcrops.	Fair: A–4 material
Chaix, thick solum variant: CIC, CID, CIE	C	Poor: very stony surface layer.	Good to poor: A–2, A–4 or A–6 material.

properties significant in engineering

mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring first column of this table]

Soil features affecting -			
Road location	Water retention		Irrigation
	Embankments	Reservoir area	
Bedrock at depth of 2½ to 3½ feet; slopes of 2 to 50 percent; low shrink-swell potential; rock outcrops in AeD and AeE.	Medium strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately rapid permeability; slopes of 2 to 50 percent; bedrock at depth of 2½ to 3½ feet; rock outcrops in AeD and AeE.	Moderately rapid intake rate; moderately rapid permeability; low to medium available water holding capacity; bedrock at depth of 2½ to 3½ feet; slopes of 2 to 50 percent.
Bedrock at depth of more than 4 feet; slopes of 2 to 50 percent; moderate shrink-swell potential; cobblestones in AgD and AgE.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 2 to 50 percent; bedrock at depth of more than 4 feet; cobblestones in AgD and AgE.	Moderate intake rate; moderately slow permeability; high available water holding capacity; bedrock at depth of more than 4 feet; slopes of 2 to 50 percent.
Bedrock at depth of 1½ to 3 feet; slopes of 2 to 30 percent; high shrink-swell potential; rock outcrops in AsD.	Medium to low strength; medium to low permeability if compacted; medium to low susceptibility to piping.	Very slow permeability; slopes of 2 to 30 percent; bedrock at depth of 1½ to 3 feet; rock outcrops in AsD.	Moderate intake rate; very slow permeability; low available water holding capacity; bedrock at depth of 1½ to 3 feet; slopes of 2 to 30 percent.
Bedrock at depth of 3 to 4 feet; slopes of 5 to 50 percent; moderate shrink-swell potential; rock outcrops in AuD and AuE.	Medium strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderate permeability; slopes of 5 to 50 percent; bedrock at depth of 3 to 4 feet; rock outcrops in AuD and AuE.	Moderately rapid intake rate; moderate permeability; medium available water holding capacity; bedrock at depth of 3 to 4 feet; slopes of 5 to 50 percent.
Bedrock at depth of 1 to 2 feet; slopes of 2 to 50 percent; low shrink-swell potential; rock outcrops in AwC, AxD, and AxE.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderate permeability; slopes of 2 to 50 percent; bedrock at depth of 1 to 2 feet; rock outcrops in AwC, AxD, and AxE.	Moderate intake rate; moderate permeability; low available water holding capacity; bedrock at depth of 1 to 2 feet; slopes of 2 to 50 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 50 percent; moderate shrink-swell potential; rock outcrops in BrD and BrE.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 5 to 50 percent; bedrock at depth of 3½ to more than 5 feet; rock outcrops in BrD and BrE.	Moderate intake rate; moderately slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 50 percent.
Bedrock at depth of 1½ to 3½ feet; slopes of 5 to 75 percent; low shrink-swell potential; rock outcrops.	Medium strength; medium to low permeability if compacted; high to moderate susceptibility to piping.	Moderately rapid permeability; slopes of 5 to 75 percent; bedrock at depth of 1½ to 3½ feet; rock outcrops.	Moderately rapid intake rate; moderately rapid permeability; low available water holding capacity; bedrock at depth of 1½ to 3½ feet; slopes of 5 to 75 percent.
Bedrock at depth of 2 to 4 feet; slopes of 5 to 50 percent; moderate shrink-swell potential; very stony surface layer.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 5 to 50 percent; bedrock at depth of 2 to 4 feet; very stony surface layer.	Moderate intake rate; moderately slow permeability; medium available water holding capacity; bedrock at depth of 2 to 4 feet; slopes of 5 to 50 percent.

TABLE 6. -*Interpretations of soil properties*

Soil series and map symbols	Hydrologic soil group	Suitability as source of	
		Topsoil	Road fill
*Cohasset: CmB, CmC, CmD, CoD, CoE, CsE, CsF For McCarthy part of CsE and CsF, see McCarthy series.	B	Fair in CmB and CmC: 5 to 15 percent gravel. Poor in CmD, CoD, CoE, CsE, and CsF: slope; cobblestones.	Fair: A-4 or A-5 material
Cut and fill land: Ct. Too variable for valid intperpretation.			
Dubakella Mapped only in complex with Rock outcrop, which is too variable for valid interpretation.	C	Poor: bedrock at depth of 1½ to 2 feet; cobbly to very cobbly; slope.	Good to poor: A-2 or A-6 material.
Dubakella, shallow variant: DrE Rock outcrop part is too variable for valid interpretation.	D	Poor: bedrock at depth of 1 to 1½ feet; slope.	Poor: A-6 material
Granitic rock land: Gr. Too variable for valid interpretation.			
Hoda: HnB, HnC, HnE, HoC2, HpF Rock outcrop part of HpF is too variable for valid interpretation.	B	Poor: sandy loam over clay; cobbly; slope.	Fair to poor: A-4 or A-7 material.
Horseshoe: HrC, HrD	B	Poor: gravelly; slope	Good to poor: A-2, A-4, or A-7 material.
Hotaw Mapped only in complex with Chaix soils.	C	Poor: gravelly; slope	Good to poor: A-2, A-4, or A-6 material.
Iron Mountain: ImE	D	Poor: bedrock at depth of 1 to 2 feet; gravelly; slope.	Good
*Josephine: JoC, JoD, JoE, JpD, JrE2, JrF2, JsE For Mariposa part of JrE2 and JrF2, see Josephine series. Rock outcrop part of JsE is too variable for valid interpretation.	B	Fair in JoC: slope. Poor in JoD, JoE, JpD, JrE2, JrF2, and JsE: slope; gravelly; cobbly; rock outcrops.	Fair to poor: A-4 or A-7 material.
*Mariposa: MaD, McF2, MkE For Maymen part of McF2, see Maymen series. Rock outcrop part of MkE is too variable for valid interpretation.	C	Poor: gravelly; slope	Good to fair: A 2 or A 4 material.

significant in engineering—Continued

Soil features affecting—			
Road location	Water retention		Irrigation
	Embankments	Reservoir area	
Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 75 percent; moderate shrink-swell potential; cobbly in CoD, CoE, CsE, and CsF.	Medium to low strength; medium to low permeability if compacted; high to medium susceptibility to piping.	Moderately slow permeability; slopes of 2 to 75 percent; bedrock at depth of 3½ to more than 5 feet; cobbly in CoD, CoE, CsE, and CsF.	Moderate intake rate; moderately slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 75 percent.
Bedrock at depth of 1½ to 2 feet; slopes of 5 to 50 percent; moderate shrink-swell potential; rock outcrops.	Medium strength; low permeability if compacted; medium to low susceptibility to piping.	Slow permeability; slopes of 5 to 50 percent; bedrock at depth of 1½ to 2 feet; rock outcrops.	Moderately slow intake rate; slow permeability; very low available water holding capacity; bedrock at depth of 1½ to 2 feet; slopes of 5 to 50 percent; very low fertility.
Bedrock at depth of 1 to 1½ feet; slopes of 2 to 50 percent; high shrink-swell potential; rock outcrops.	Medium to low strength; low permeability if compacted; medium to low susceptibility to piping.	Very slow permeability; slopes of 2 to 50 percent; bedrock at depth of 1 to 1½ feet; rock outcrops.	Slow intake rate; very slow permeability; very low available water holding capacity; bedrock at depth of 1 to 1½ feet; slopes of 2 to 50 percent; very low fertility.
Bedrock at depth of more than 5 feet; slopes of 5 to 75 percent; moderate shrink-swell potential; cobbly in HoC2; rock outcrops in HpF.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 5 to 75 percent; bedrock at depth of more than 5 feet; cobbly in HoC2; rock outcrops in HpF.	Moderately rapid intake rate; moderately slow permeability; high available water holding capacity; bedrock at depth of more than 5 feet; slopes of 5 to 75 percent.
Sand and gravel at depth of 4 to 6 feet; slopes of 9 to 30 percent; low shrink-swell potential.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderate permeability; slopes of 9 to 30 percent; sand and gravel at depth of 4 to 6 feet.	Moderate intake rate; moderate permeability; medium to high available water holding capacity; sand and gravel at depth of 4 to 6 feet; slopes of 9 to 30 percent.
Bedrock at depth of 2 to 3½ feet; slopes of 5 to 50 percent; moderate shrink-swell potential; rock outcrops.	Medium strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 5 to 50 percent; bedrock at depth of 2 to 3½ feet; rock outcrops.	Moderately rapid intake rate; moderately slow permeability; low available water holding capacity; bedrock at depth of 2 to 3½ feet; slopes of 5 to 50 percent.
Bedrock at depth of 1 to 2 feet; slopes of 2 to 50 percent; low shrink-swell potential; cobbly.	Medium strength; medium to low permeability if compacted; high susceptibility to piping.	Moderately rapid permeability; slopes of 2 to 50 percent; bedrock at depth of 1 to 2 feet; cobbly.	Moderately rapid intake rate; moderately rapid permeability; very low available water holding capacity; bedrock at depth of 1 to 2 feet; slopes of 2 to 50 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 75 percent; low shrink-swell potential; cobbly in JpD; rock outcrops in JrF2 and JsE.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderate permeability; slopes of 5 to 75 percent; bedrock at depth of 3½ to more than 5 feet; cobbly in JpD; rock outcrops in JrF2 and JsE.	Moderate intake rate; moderate permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 75 percent.
Bedrock at depth of 1½ to 2½ feet; slopes of 2 to 75 percent; moderate shrink-swell potential; rock outcrops in McF2 and MkE.	High to medium strength; medium to low permeability if compacted; medium to low susceptibility to piping.	Moderate permeability; slopes of 2 to 75 percent; bedrock at depth of 1½ to 2½ feet; rock outcrops in McF2 and MkE.	Moderate intake rate; moderate permeability; very low to low available water holding capacity; bedrock at depth of 1½ to 2½ feet; slopes of 2 to 75 percent.

TABLE 6.—*Interpretations of soil properties*

Soil series and map symbols	Hydrologic soil group	Suitability as sources of—	
		Topsoil	Road fill
*Maymen: MmE2 For Mariposa part, see Mariposa series.	D	Poor: bedrock at depth of 1 to 1½ feet; slope; gravelly.	Fair: A–4 material.
McCarthy: MnE	C	Poor: slope.	Fair: A–4 material.
MoC, MoE	C	Poor: gravelly; slope.	Fair: A–4 material.
Musick: MrC, MrE, MsE Rock outcrop part of MsE is too variable for valid interpretation.	B	Fair in MrC: slope. Poor in MrE and MsE: slope; rock outcrops.	Fair to poor: A–4 or A–7 material.
Placer diggings: Pr. Too variable for valid interpretation.			
Rescue: RkD Rock outcrop part is too variable for valid interpretation.	B	Poor: slope; rock outcrops.	Fair to poor: A–4 or A–6 material.
Rock land: Rn. Too variable for valid interpretation.			
Rock outcrop: RoE, RpD, RrE. Too variable for valid interpretation. For Ahwahnee part of RoE, see Ahwahnee series; for Auburn part of RpD, see Auburn series; for Dubakella part of RrE, see Dubakella series.			
Secca: ScE Rock outcrop part is too variable for valid interpretation.	C	Poor: slope; rock outcrops; gravelly.	Fair to poor: A–4 or A–7 material.
Shenandoah: SdC	D	Fair: sandy loam over clay; slope.	Good to poor: A–1, A–2, or A–7 material.
Sierra: SfB, SfC, SfD, SkD, SkE Rock outcrop parts of SkD and SkE are too variable for valid interpretation.	B	Good in SfB. Fair in SfC: slope. Poor in SfD, SkD, and SkE: slope; rock outcrops.	Good to poor: A–2, A–4, or A–6 material.

significant in engineering—Continued

Soil features affecting—			
Road location	Water retention		Irrigation
	Embankments	Reservoir area	
Bedrock at depth of 1 to 1½ feet; slopes of 2 to 75 percent; low shrink-swell potential; rock outcrops.	Medium strength; medium to low permeability if compacted; high to medium susceptibility to piping.	Moderate permeability; slopes of 2 to 75 percent; bedrock at depth of 1 to 1½ feet; rock outcrops.	Moderate intake rate; moderate permeability; very low available water holding capacity; bedrock at depth of 1 to 1½ feet; slopes of 2 to 75 percent.
Bedrock at depth of 1½ to 2½ feet; slopes of 15 to 50 percent; low shrink-swell potential.	Medium to low strength; medium to low permeability if compacted; high susceptibility to piping.	Moderately rapid permeability; slopes of 15 to 50 percent; bedrock at depth of 1½ to 2½ feet.	Moderately rapid intake rate; moderately rapid permeability; low available water holding capacity; bedrock at depth of 1½ to 2½ feet; slopes of 15 to 50 percent.
Bedrock at depth of 1½ to 2½ feet; slopes of 5 to 50 percent; low shrink-swell potential; cobbly.	Medium strength; low permeability if compacted; medium to low susceptibility to piping.	Moderate permeability; slopes of 5 to 50 percent; bedrock at depth of 1½ to 2½ feet; cobbly.	Moderately rapid intake rate; moderate permeability; low available water holding capacity; bedrock at depth of 1½ to 2½ feet; slopes of 5 to 50 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 50 percent; moderate shrink-swell potential; rock outcrops in MsE.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 5 to 50 percent; bedrock at depth of 3½ to more than 5 feet; rock outcrops in MsE.	Moderate intake rate; moderately slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to 5 feet; slopes of 5 to 50 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 30 percent; moderate shrink-swell potential; rock outcrops.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 5 to 30 percent; bedrock at depth of 3½ to more than 5 feet; rock outcrops.	Moderate intake rate; moderately slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 30 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent; high shrink-swell potential; rock outcrops.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Slow permeability; slopes of 2 to 50 percent; bedrock at depth of 3½ to more than 5 feet; rock outcrops.	Moderately slow intake rate; slow permeability; low to medium available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent.
Bedrock at depth of 2 to 3½ feet; slopes of 2 to 15 percent; high shrink-swell potential.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Very slow permeability; slopes of 2 to 15 percent; bedrock at depth of 2 to 3½ feet.	Moderately rapid intake rate; very slow permeability; low available water holding capacity; bedrock at depth of 2 to 3½ feet; slopes of 2 to 15 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent; moderate shrink-swell potential; rock outcrops in SkD and SkE.	Medium strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 2 to 50 percent; bedrock at depth of 3½ to more than 5 feet; rock outcrops in SkD and SkE.	Moderate intake rate; moderately slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent.

TABLE 6.—*Interpretations of soil properties*

Soil series and map symbols	Hydrologic soil group	Suitability as sources of—	
		Topsoil	Road fill
Sites: SIB, SIC, SID, SmC, SmE	B	Good in SIB. Fair in SIC: slope. Poor in SID, SmC, and SmE: slope; very stony.	Fair to poor: A–5, or A–7 material.
Sobrante: SoC, SoD, SrD, SrE Rock outcrop parts of SrD and SrE are too variable for valid interpretation.	C	Fair in SoC: slope. Poor in SoD, SrD, and SrE: slope; rock outcrops.	Fair to poor: A–4 or A–6 material.
Tailings: Ta. Too variable for valid interpretation.			
Trabuco: TrC, TuD, TuE Rock outcrop parts of TuD and TuE are too variable for valid interpretation.	C	Fair in TrC: loam over clay; slope. Poor in TuD and TuE: slope; rock outcrops.	Fair to poor: A–4, A–6 or A–7 material.

many kinds of buildings, mostly houses and light industrial or commercial structures. Also important is information about the erodibility of a disturbed soil.

The nature of the soil limitations and their ratings are shown in table 7. The ratings used to describe the limitation of each soil generally are *slight, moderate,* or *severe.* Some ratings, however, are listed as *low, moderate,* or *high.* The ratings are based on the greatest single limitation, but sometimes more than one limitation is listed. The rating of *slight* or *low* indicates that the soil has few or no limitations. Little or no adjustment is needed for the indicated use, and no limitations are shown. A rating of *moderate* means that some adjustments are needed for the indicated use. A rating of *severe* or *high* means that extensive adjustments are needed before the soil is suitable for the indicated use.

In the paragraphs that follow and in table 7, nonfarm uses are defined and the soil properties and qualities important in rating the soil limitations for such uses are given. This information can be related to information in other parts of this survey. Soil maps at the back of the survey can be used to guide planning. Onsite investigations should be made, however, before beginning construction or other actual use.

In the following paragraphs, for each major nonfarm use, the soil characteristics that determine the ratings *slight* and *severe* and the degree to which these soil characteristics are expressed are explained in detail. The reasons for so rating a soil are apparent and easy to understand. For a rating of *moderate,* these same soil characteristics apply to an intermediate degree, but they are not so easy to define or understand. For this reason, ratings of moderate can be better comprehended by reading the detailed descriptions of the relevant mapping units.

Dwellings.—The ratings and limitations in table 7 are for houses and structures no more than three stories high. The soil properties and qualities most important in rating soils for this use are soil drainage class, presence of stones in the soil, and rock outcrops. Also important are shrink-swell potential, depth to hard bedrock or to an impervious layer, and slope. Kind of sewage system is not considered a part of the evaluation for residences. These ratings for dwellings can also be applied to light industrial buildings and structures used as recreation facilities.

Soils rated *slight* are excessively drained to moderately well drained, have slopes of 0 to 8 percent, low shrink-swell potential, and no stones or rock outcrops. They are more than 40 inches deep to bedrock. Soils rated *moderate* are somewhat poorly drained, have slopes of 8 to 15 percent, moderate shrink-swell potential, or as much as 3 percent of the surface covered by stones or 2 to 10 percent of the surface covered by rock outcrops. They are 20 to 40 inches deep to bedrock in places. Soils rated *severe* are poorly drained to very poorly drained, have a high shrink-swell potential, slopes of more than 15 percent, or more than 3 percent of the surface covered by stones or more than 10 percent of the surface covered by rock outcrops. They are less than 20 inches deep to bedrock in places.

Excavation.—The soil is classified in relation to the percentage of rock outcrop exposed on the surface, percent of cobblestones or stones, and depth to hard bedrock or other impervious material. The presence of cobblestones, stones, or rock in the upper 5 feet of soil significantly affects the ease with which a soil can be

significant in engineering Continued

Soil features affecting—			
Road location	Water retention		Irrigation
	Embankments	Reservoir area	
Bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent; moderate shrink-swell potential; very stony in SmC and SmE.	Medium to low strength; medium to low permeability if compacted; high to low susceptibility to piping.	Moderately slow permeability; slopes of 2 to 50 percent; bedrock at depth of 3½ to more than 5 feet; very stony in SmC and SmE.	Moderate intake rate; moderately slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 2 to 50 percent.
Bedrock at depth of 2 to 3 feet; slopes of 2 to 50 percent; moderate shrink-swell potential; rock outcrops in SrD and SrE.	Medium to low strength; medium to low permeability if compacted; medium to low susceptibility to piping.	Moderate permeability; slopes of 2 to 50 percent; bedrock at depth of 2 to 3 feet; rock outcrops in SrD and SrE.	Moderate intake rate; moderate permeability; low to medium available water holding capacity; bedrock at depth of 2 to 3 feet; slopes of 2 to 50 percent.
Bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 50 percent; moderate shrink-swell potential; rock outcrops in TuD and TuE.	Medium to low strength; medium to low permeability if compacted; high to medium susceptibility to piping.	Slow permeability; slopes of 5 to 50 percent; bedrock at depth of 3½ to more than 5 feet; rock outcrops in TuD and TuE.	Moderate intake rate; slow permeability; medium to high available water holding capacity; bedrock at depth of 3½ to more than 5 feet; slopes of 5 to 50 percent.

excavated for pipelines, roads, or other construction. Soft or weathered rock that has a hardness of less than 3 on the MOHS Scale can be excavated easily by commonly used earthmoving equipment. Gravel may be present in any amount without affecting the ease of excavation. For this interpretation the percent of stones in the soil profile is estimated by volume in a manner similar to that for gravel and cobblestones.

Soils that are less than 2 percent rock outcrop exposures, less than 3 percent cobblestones or stones by volume, and are more than 60 inches deep are rated *slight*. Soils that are 2 to 10 percent rock outcrop exposures, 3 to 15 percent cobblestones and stones by volume, or are 40 to 60 inches deep are rated *moderate*. Soils that are more than 10 percent rock outcrop exposures, more than 15 percent cobblestones or stones by volume, or are less than 40 inches deep to hard bedrock are rated *severe*.

Septic tank filter fields.—A septic tank filter field is a sewage system in which waste is distributed to a central tank and the effluent from the tank is dispersed over a very large filter field by lines buried in the soil. The properties and qualities most important in rating the soils for the proper operation of such a system are depth to hard rock, impervious substratum or seasonal high water table, subsoil texture, permeability, slope, percolation rate, and natural drainage. None of the soils in the survey area are considered as having an exclusively slight limitation for use as septic tank filter fields. At least one characteristic or quality limits these soils, and all soils have at least a slight to moderate limitation.

Soils rated *moderate* have slopes of 5 to 9 percent, depths of more than 4 feet, and naturally good drainage. All other soils are rated *severe* because they have slopes of more than 9 percent, or are less than 4 feet deep, even if the natural drainage is good. In many places a limitation results from reduced percolation and subsoil permeability.

Generally, soils rated *slight* have a percolation rate of more than 45 minutes per inch and a permeability of more than 1 inch per hour. They are excessively drained to well drained, are more than 6 feet deep, and have slopes of less than 5 percent. In contrast, soils rated *severe* have a percolation rate of less than 75 minutes per inch, have a permeability of less than .63 inch per hour, or are poorly drained or very poorly drained. Also, they are less than 4 feet deep and have slopes of more than 9 percent in places.

Corrosivity of uncoated steel (pipe).—Soil corrosivity relates to certain physical and chemical characteristics and qualities of soils. The limitations are based on such soil properties as texture, conductivity, and total acidity and drainage, which is influenced by slope, depth, position, subsoil texture, and underlying layers. It is assumed that the steel structure or pipe is located in the subsoil, or B horizon, of the soil. If pipe is located in other horizons, the limitations for these horizons must be considered.

Soils rated *low* have a total acidity of less than 8, are coarse textured, moderately coarse textured or medium textured, and are well drained, somewhat excessively drained, or excessively drained. Soils rated *moderate* have a total acidity of 8 to 12, are moderately fine textured, medium textured or moderately coarse textured, or are well drained, moderately well drained, or somewhat poorly drained. Soils rated *high* have a total acidity of more than 12, are moderately fine tex-

TABLE 7. *-Interpretations of the soils for use in community development*

Soil	Soil limitations for—			Ratings for —	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
Ahwahnee sandy loam, 2 to 9 percent slopes.	Moderate: bedrock at depth of 30 to 40 inches.	Slight	Severe: bedrock at depth of 30 to 40 inches.	Low	Low.
Ahwahnee sandy loam, 9 to 15 percent slopes.	Moderate: bedrock at depth of 30 to 40 inches; slope.	Slight	Severe: bedrock at depth of 30 to 40 inches; slope.	Low	Low.
Ahwahnee sandy loam, 15 to 30 percent slopes.	Severe: slope	Slight	Severe: bedrock at depth of 30 to 40 inches; slope.	Low	Low.
Ahwahnee-Rock outcrop complex, 15 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 30 to 40 inches; slope.	Low	Low.
Ahwahnee-Rock outcrop complex, 30 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 30 to 40 inches; slope.	Low	Low.
Aiken loam, 2 to 9 percent slopes.	Moderate: moderate shrink-swell potential.	Slight	Severe: moderately slow permeability.	Moderate: total acidity 8 to 12.	Moderate: more than 35 percent kaolinitic clay.
Aiken loam, 9 to 15 percent slopes.	Moderate: moderate shrink-swell potential.	Slight	Severe: moderately slow permeability; slope.	Moderate: total acidity 8 to 12.	Moderate: more than 35 percent kalonitic clay.
Aiken loam, 15 to 30 percent slopes.	Severe: slope	Slight	Severe: moderately slow permeability; slope.	Moderate: total acidity 8 to 12.	Moderate: more than 35 percent kaolinitic clay.
Aiken loam, 30 to 50 percent slopes.	Severe: slope	Slight	Severe: moderately slow permeability; slope.	Moderate: total acidity 8 to 12.	Moderate: more than 35 percent kaolinitic clay.
Aiken cobbly loam, 2 to 30 percent slopes.	Severe: 15 to 30 percent cobblestones; slope.	Severe: 15 to 30 percent cobblestones.	Severe: moderately slow permeability; slope.	Moderate: total acidity 8 to 12.	Moderate: more than 35 percent kaolinitic clay.
Aiken cobbly loam, 30 to 50 percent slopes.	Severe: 15 to 30 percent cobblestones; slope.	Severe: 15 to 30 percent cobblestones.	Severe: moderately slow permeability; slope.	Moderate: total acidity 8 to 12.	Moderate: more than 35 percent kaolinitic clay.
Alluvial land, clayey	Variable	Variable	Variable	Variable	Variable.
Alluvial land, loamy	Variable	Variable	Variable	Variable	Variable.
Argonaut gravelly loam, 2 to 15 percent slopes.	Severe: high shrink-swell potential.	Severe: bedrock at depth of 18 to 36 inches.	Severe: very slow permeability.	High: fine texture	High: more than 35 percent mixed clays.
Argonaut-Rock outcrop complex, 2 to 30 percent slopes. [2]	Severe: high shrink-swell potential; 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 18 to 36 inches; 10 to 25 percent rock outcrops.	Severe: very slow permeability.	High: fine texture	High: more than 35 percent mixed clays.
Auberry sandy loam, 5 to 15 percent slopes.	Moderate: moderate shrink-swell potential; slope.	Moderate: bedrock at depth of 36 to 46 inches.	Slight to moderate: moderate permeability.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Auberry-Rock outcrop complex, 15 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: slope	Moderate: moderately fine texture.	Moderate: 18 to 25 percent mixed clays.
Auberry-Rock outcrop complex, 30 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: slope	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.

See footnote at end of table.

TABLE 7.—*Interpretations of the soils for use in community development* Continued

Soil	Soil limitations for—			Ratings for—	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
Auburn loam, 2 to 30 percent slopes.	Severe: bedrock at depth of 14 to 27 inches.	Severe: bedrock at depth of 14 to 27 inches.	Severe: bedrock at depth of 14 to 27 inches.	Low	Low.
Auburn-Argonaut complex, 2 to 15 percent slopes:					
Auburn part	Severe: bedrock at depth of 14 to 27 inches.	Severe: bedrock at depth of 14 to 27 inches.	Severe: bedrock at depth of 14 to 27 inches.	Low	Low.
Argonaut part	Severe: high shrink-swell potential.	Severe: bedrock at depth of 18 to 36 inches.	Severe: slow permeability.	High: fine texture	High: more than 35 percent mixed clays.
Auburn-Rock outcrop complex, 2 to 30 percent slopes. [2]	Severe: bedrock at depth of 14 to 27 inches; 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 14 to 27 inches; 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 14 to 27 inches; slope.	Low	Low.
Auburn-Rock outcrop complex, 30 to 50 percent slopes. [2]	Severe: bedrock at depth of 14 to 27 inches; 10 to 25 percent rock outcrops; slope.	Severe: bedrock at depth of 14 to 27 inches; 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 14 to 27 inches; slope.	Low	Low.
Boomer loam, 5 to 15 percent slopes.	Moderate: moderate shrink-swell potential; slope.	Slight to moderate: 0 to 10 percent rock outcrops.	Severe: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Boomer loam, 15 to 30 percent slopes.	Severe: slope	Slight to moderate: 0 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Boomer-Rock outcrop complex, 5 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops.	Severe: 10 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Boomer-Rock outcrop complex, 30 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: Moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Chaix sandy loam, 15 to 50 percent slopes, eroded.	Severe: slope	Moderate: 2 to 10 percent rock outcrops.	Severe: bedrock at depth of 20 to 40 inches; slope.	Low	Low.
Chaix-Hotaw complex, 5 to 15 percent slopes, eroded:					
Chaix part	Moderate: 2 to 10 percent rock outcrops.	Moderate: 2 to 10 percent rock outcrops.	Severe: bedrock at depth of 20 to 40 inches; slope.	Low	Low.
Hotaw part	Moderate: 2 to 10 percent rock outcrops.	Moderate: 2 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Chaix-Hotaw complex, 15 to 30 percent slopes, eroded:					
Chaix part	Severe: slope	Moderate: 2 to 10 percent rock outcrops.	Severe: bedrock at depth of 20 to 40 inches; slope.	Low	Low.
Hotaw part	Severe: slope	Moderate: 2 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.

See footnote at end of table.

TABLE 7.—*Interpretations of the soils for use in community development*—Continued

Soil	Soil limitations for—			Ratings for—	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
Chaix-Hotaw complex, 30 to 50 percent slopes, eroded:					
Chaix part	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 20 to 40 inches; slope.	Low	Low.
Hotaw part	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Chaix-Rock outcrop complex, 30 to 75 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 20 to 40 inches; slope.	Low	Moderate: 18 to 35 percent mixed clays.
Chaix very stony loam, thick solum variant, 5 to 15 percent slopes.	Severe: 2 to 12 percent cobblestones and stones.	Severe: 2 to 12 percent cobblestones and stones.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Chaix very stony loam, thick solum variant, 15 to 30 percent slopes.	Severe: 2 to 12 percent cobblestones and stones; slope.	Severe: 2 to 12 percent cobblestones and stones.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Chaix very stony loam, thick solum variant, 30 to 50 percent slopes.	Severe: 2 to 12 percent cobblestones and stones; slope.	Severe: 2 to 12 percent cobblestones and stones.	Severe: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Cohasset loam, 2 to 9 percent slopes.	Slight	Slight	Severe: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Cohasset loam, 9 to 15 percent slopes.	Moderate: slope	Slight	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Cohasset loam, 15 to 30 percent slopes.	Severe: slope	Slight	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Cohasset cobbly loam, 5 to 30 percent slopes.	Severe: 10 to 35 percent cobblestones; slope.	Severe: 10 to 35 percent cobblestones.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Cohasset cobbly loam, 30 to 50 percent slopes.	Severe: 15 to 40 percent cobblestones; slope.	Severe: 15 to 40 percent cobblestones.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Cohasset-McCarthy cobbly loams, 15 to 50 percent slopes:					
Cohasset part	Severe: 15 to 35 percent cobblestones; slope.	Severe: 15 to 35 percent cobblestones.	Severe: slope	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
McCarthy part	Severe: 15 to 35 percent cobblestones; bedrock at depth of 18 to 32 inches; slope.	Severe: 15 to 35 percent cobblestones; bedrock at depth of 18 to 32 inches.	Severe: bedrock at depth of 18 to 32 inches; slope.	Moderate: total acidity 8 to 12.	Low.
Cohasset-McCarthy cobbly loams, 50 to 75 percent slopes.					
Cohasset part	Severe: 15 to 35 percent cobblestones.	Severe: 15 to 35 percent cobblestones.	Severe: slope	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
McCarthy part	Severe: 15 to 35 percent cobblestones; bedrock at depth of 18 to 32 inches; slope.	Severe: 15 to 35 percent cobblestones; bedrock at depth of 18 to 32 inches.	Severe: bedrock at depth of 18 to 32 inches; slope.	Moderate: total acidity 8 to 12.	Low.

See footnote at end of table.

TABLE 7.—*Interpretations of the soils for use in community development*—Continued

Soil	Soil limitations for—			Ratings for—	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
Cut and fill land	Variable	Variable	Variable	Variable	Variable.
Dubakella, shallow variant-Rock outcrop complex, 2 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; bedrock at depth of 10 to 20 inches; slope.	Severe: 10 to 25 percent rock outcrops; bedrock at depth of 10 to 20 inches.	Severe: bedrock at depth of 10 to 20 inches; slope; very slow permeability.	High: fine texture	High: more than 35 percent serpentinitic clays.
Granitic rock land	Variable	Variable	Variable	Variable	Variable.
Hoda sandy loam, 5 to 9 percent slopes	Slight	Slight	Severe: moderately slow permeability.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Hoda sandy loam, 9 to 15 percent slopes	Moderate: slope	Slight	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Hoda sandy loam, 15 to 50 percent slopes.	Severe: slope	Slight	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Hoda cobbly sandy loam, 2 to 15 percent slopes, eroded.	Severe: 15 to 30 percent cobblestones and stones; 2 to 10 percent rock outcrops.	Severe: 15 to 30 percent cobblestones and stones; 2 to 10 percent rock outcrops.	Severe: moderately slow permeability.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Hoda-Rock outcrop complex, 50 to 75 percent slopes. [2]	Severe: 15 to 25 percent rock outcrops; slope.	Severe: 15 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Horseshoe gravelly loam, 9 to 15 percent slopes.	Moderate: slope	Slight	Severe: slope	High: total acidity greater than 12.	Low.
Horseshoe gravelly loam, 15 to 30 percent slopes.	Severe: slope	Slight	Severe: slope	High: total acidity greater than 12.	Low.
Iron Mountain cobbly loam, 2 to 15 percent slopes.	Severe: 15 to 30 percent cobblestones; bedrock at depth of 12 to 22 inches; slope.	Severe: 15 to 30 percent cobblestones; bedrock at depth of 12 to 22 inches; slope.	Severe: bedrock at depth of 12 to 22 inches; slope.	Low	Low.
Josephine loam, 9 to 15 percent slopes.	Moderate: slope	Slight	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.
Josephine loam, 15 to 30 percent slopes.	Severe: slope	Slight	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.
Josephine loam, 30 to 50 percent slopes.	Severe: slope	Slight	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.
Josephine cobbly loam, 5 to 30 percent slopes.	Severe: 20 to 25 percent cobblestones; slope.	Severe: 20 to 25 percent cobblestones.	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.

See footnote at end of table.

TABLE 7.—*Interpretations of the soils for use in community development*—Continued

Soil	Soil limitations for —			Ratings for—	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
Josephine-Mariposa complex, 15 to 50 percent slopes, eroded:					
Josephine part	Severe: slope	Slight	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.
Mariposa part	Severe: bedrock at depth of 15 to 31 inches; slope.	Severe: bedrock at depth of 15 to 31 inches.	Severe: bedrock at depth of 15 to 31 inches; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Josephine-Mariposa complex, 50 to 75 percent slopes, eroded:					
Josephine part	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops; slope.	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.
Mariposa part	Severe: 10 to 25 percent rock outcrops; bedrock at depth of 15 to 31 inches; slope.	Severe: 10 to 25 percent rock outcrops; bedrock at depth of 15 to 31 inches.	Severe: bedrock at depth of 15 to 31 inches; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Josephine-Rock outcrop complex, 15 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: slope	Moderate: moderately fine texture; total acidity 8 to 12.	Low.
Mariposa gravelly loam, 2 to 30 percent slopes.	Severe: bedrock at depth of 15 to 31 inches; slope.	Severe: bedrock at depth of 15 to 31 inches.	Severe: bedrock at depth of 15 to 31 inches; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Mariposa-Maymen complex, 50 to 75 percent slopes, eroded:					
Mariposa part	Severe: 2 to 25 percent rock outcrops; bedrock at depth of 15 to 31 inches; slope.	Severe: 2 to 25 percent rock outcrops; bedrock at depth of 15 to 31 inches.	Severe: bedrock at depth of 15 to 31 inches; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Maymen part	Severe: 2 to 25 percent rock outcrops; bedrock at depth of 12 to 18 inches; slope.	Severe: 2 to 25 percent rock outcrops; bedrock at depth of 12 to 18 inches.	Severe: bedrock at depth of 12 to 18 inches; slope.	Moderate: total acidity 8 to 12.	Low.
Mariposa-Rock outcrop complex, 2 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; bedrock at depth of 15 to 31 inches; slope.	Severe: 10 to 25 percent rock outcrops; bedrock at depth of 15 to 31 inches.	Severe: bedrock at depth of 15 to 31 inches; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Maymen-Mariposa complex, 2 to 50 percent slopes, eroded:					
Maymen part	Severe: 2 to 15 percent rock outcrops; bedrock at depth of 12 to 18 inches; slope.	Severe: 2 to 15 percent rock outcrops; bedrock at depth of 12 to 18 inches; slope.	Severe: bedrock at depth of 12 to 18 inches slope.	Moderate: total acidity 8 to 12.	Low.
Mariposa part	Severe: 2 to 15 percent rock outcrops; bedrock at depth of 15 to 31 inches; slope.	Severe: 2 to 15 percent rock outcrops; bedrock at depth of 15 to 31 inches.	Severe: bedrock at depth of 15 to 31 inches; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
McCarthy sandy loam, 15 to 50 percent slopes.	Severe: bedrock at depth of 18 to 32 inches; slope.	Severe: bedrock at depth of 18 to 32 inches.	Severe: bedrock at depth of 18 to 32 inches; slope.	Moderate: total acidity 8 to 12.	Low.

See footnotes at end of table.

TABLE 7.—*Interpretations of the soils for use in community development*—Continued

Soil	Soil limitations for—			Ratings for—	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
McCarthy cobbly loam, 5 to 15 percent slopes.	Severe: 15 to 50 percent cobblestones; bedrock at depth of 18 to 32 inches.	Severe: 15 to 50 percent cobblestones; bedrock at depth of 18 to 32 inches.	Severe: bedrock at depth of 18 to 32 inches; slope.	Moderate: total acidity 8 to 12.	Low.
McCarthy cobbly loam, 15 to 50 percent slopes.	Severe: 15 to 50 percent cobblestones; bedrock at depth of 18 to 32 inches; slope.	Severe: 15 to 50 percent cobblestones; bedrock at depth of 18 to 32 inches.	Severe: bedrock at depth of 18 to 32 inches; slope.	Moderate: total acidity 8 to 12.	Low.
Musick sandy loam, 5 to 15 percent slopes.	Moderate: 2 to 10 percent rock outcrops; slope.	Moderate: 2 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Musick sandy loam, 15 to 50 percent slopes.	Severe: slope	Moderate: 2 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Musick-Rock outcrop complex, 5 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture; total acidity 8 to 12.	Moderate: 18 to 35 percent mixed clays.
Placer diggings	Variable	Variable	Variable	Variable	Variable.
Rescue-Rock outcrop complex, 5 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Rock land	Variable	Variable	Variable	Variable	Variable.
Rock-outcrop-Ahwahnee complex, 9 to 50 percent slopes. [2]	Severe: 25 to 50 percent rock outcrops; slope.	Severe: 25 to 50 percent rock outcrops; slope.	Severe: bedrock at depth of 30 to 40 inches; slope.	Low	Low.
Rock outcrop-Auburn complex, 2 to 30 percent slopes. [2]	Severe: bedrock at depth of 14 to 27 inches; 25 to 50 percent rock outcrops; slope.	Severe: bedrock at depth of 14 to 27 inches; 25 to 50 percent rock outcrops.	Severe: bedrock at depth of 14 to 27 inches; slope.	Low	Low.
Rock outcrop-Dubakella complex, 5 to 50 percent slopes. [2]	Severe: bedrock at depth of 20 to 26 inches; 25 to 50 percent rock outcrops; slope.	Severe: bedrock at depth of 20 to 26 inches; 25 to 50 percent rock outcrops.	Severe: bedrock at depth of 20 to 26 inches; slope.	High: fine texture	Moderate: more than 35 percent serpentinitic clay; 30 to 50 percent gravel and cobblestones.
Secca-Rock outcrop complex, 2 to 50 percent slopes. [2]	Severe: 10 to 40 percent rock outcrops; high shrink-swell potential; slope.	Severe: 10 to 40 percent rock outcrops.	Severe: slow permeability; slope.	High: fine texture	High: more than 35 percent mixed clays.
Shenandoah sandy loam, 2 to 15 percent slopes.	Severe: high shrink-swell potential.	Slight	Severe: very slow permeability; bedrock at depth of 27 to 40 inches.	High: fine texture	High: more than 35 percent montmorillonitic clay.
Sierra sandy loam, 2 to 9 percent slopes.	Slight to moderate: 0 to 10 percent rock outcrops.	Slight to moderate: 0 to 10 percent rock outcrops.	Severe: moderately slow permeability.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sierra sandy loam, 9 to 15 percent slopes.	Moderate: 0 to 10 percent rock outcrops.	Slight to moderate: 0 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.

See footnote at end of table.

TABLE 7.—*Interpretations of the soils for use in community development*—Continued

Soil	Soil limitations for—			Ratings for—	
	Dwellings	Excavation	Septic tank filter fields	Corrosivity of uncoated steel [1]	Shrink-swell potential
Sierra sandy loam, 15 to 30 percent slopes.	Severe: slope	Slight to moderate: 0 to 10 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sierra-Rock outcrop complex, 15 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sierra-Rock outcrop complex, 30 to 50 percent slopes [2].	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: moderately slow permeability; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sites loam, 2 to 9 percent slopes.	Slight	Slight	Severe: moderately slow permeability.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Sites loam, 9 to 15 percent slopes.	Moderate: slope	Slight	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Sites loam, 15 to 30 percent slopes.	Severe: slope	Slight	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Sites very stony loam, 2 to 15 percent slopes.	Severe: 10 to 25 percent stones and cobblestones.	Severe: 10 to 25 percent stones and cobblestones.	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Sites very stony loam, 15 to 50 percent slopes.	Severe: 10 to 25 percent stones and cobblestones; slope.	Severe: 10 to 25 percent stones and cobblestones.	Severe: moderately slow permeability; slope.	High: fine texture; total acidity greater than 12.	Moderate: more than 35 percent kaolinitic clay.
Sobrante loam, 2 to 15 percent slopes.	Moderate: bedrock at depth of 24 to 36 inches; 0 to 10 percent rock outcrops; slope.	Severe: bedrock at depth of 24 to 36 inches.	Severe: bedrock at depth of 24 to 36 inches; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sobrante loam, 15 to 30 percent slopes.	Severe: slope	Severe: bedrock at depth of 24 to 36 inches.	Severe: bedrock at depth of 24 to 36 inches; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sobrante-Rock outcrop complex, 2 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: bedrock at depth of 24 to 36 inches; 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 24 to 36 inches; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Sobrante-Rock outcrop complex, 30 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope	Severe: bedrock at depth of 24 to 36 inches; 10 to 25 percent rock outcrops.	Severe: bedrock at depth of 24 to 36 inches; slope.	Moderate: moderately fine texture.	Moderate: 18 to 35 percent mixed clays.
Tailings	Variable	Variable	Variable	Variable	Variable.
Trabuco loam, 5 to 15 percent slopes.	Moderate: 0 to 10 percent rock outcrops; slope.	Moderate: 0 to 10 percent rock outcrops.	Severe: slow permeability; slope.	High: fine texture	Moderate: 35 percent mixed clays.
Trabuco-Rock outcrop complex, 15 to 30 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: slow permeability; slope.	High: fine texture	Moderate: 35 percent mixed clays.
Trabuco-Rock outcrop complex, 30 to 50 percent slopes. [2]	Severe: 10 to 25 percent rock outcrops; slope.	Severe: 10 to 25 percent rock outcrops.	Severe: slow permeability; slope.	High: fine texture	Moderate: 35 percent mixed clays.

[1] Total acidity figures for corrosivity are given as meq. H + per 100 gms. of soil.
[2] Rock outcrop part not rated.

tured or fine textured, and well drained or are moderately well drained to somewhat poorly drained or poorly drained. Total acidity has been determined for selected soils.

Shrink-swell potential.—Shrink-swell potential is that quality of the soil that determines its volume change with change in moisture content. The volume-change potential of soils is influenced by the amount of moisture change and the amount and kind of clay in the soil. Classification for shrink-swell potential is based on the B horizon, or subsoil. Interpretations are for light-weight structures of less than four stories.

Soils rated *low* are from 0 to 18 percent mixed or montmorillonitic clay mineral or from 0 to 35 percent kaolinitic clay. They have a coefficient of linear extensibility (COLE), expressed in inches per inch, of less than 0.03. The soils rated *moderate* are 18 to 35 percent mixed or montmorillonitic clays or more than 35 percent kaolinitic clay. They have a COLE of 0.03 to 0.06. Soils rated *high* are more than 35 percent mixed or montmorillonitic clays and a COLE of 0.06. The percent and type of clay and the COLE for selected soils have been determined by laboratory analysis and are recorded in table 9 on page 96.

In planning the use of soils for different kinds of community development, reliable information about soils is necessary if the best use is to be determined. Generally, the soils most suitable for farming are the soils that are also most suitable for building sites and other nonfarm uses. Some soils, however, are more suitable for one kind of use than another. The nature of the individual soils themselves, therefore, is an important consideration in any orderly plan for land use. Individual soils are described in the section "Descriptions of the Soils."

Formation and Classification of the Soils

This section describes the geologic and geomorphic history of the Nevada County Area and explains the factors affecting soil formation, the soil-forming processes as they relate to soil morphology, and the classification of the soils.

Geology and Geomorphic History

A summary of the geologic and geomorphic history can be helpful in understanding the relationship between parent material and relief in the survey area. Such a summary follows.

The Nevada County Area is in the Sierra Nevada geomorphic province and lies on the western slope of the Sierra Nevada Range. Early in geologic time, in the late Paleozoic period, the Area was covered by a vast inland sea in which large amounts of several kinds of sediment were deposited. The sediment of this sea was uplifted and folded to form the metamorphic rocks of the Calaveras group. After that came fine-grained marine deposits, which formed the Mariposa formation. Intense folding and metamorphism followed, which destroyed the sea once more. As a result, nearly continuous belts of vertically tilted rocks that have ridges extending generally to the northwest were formed. Fine-grained sedimentary rock was changed to slate; siliceous sediment, to quartzites and metacherts; volcanic rock, to amphibolite schists and greenstone; and calcareous ooze, to crystalline limestone.

Then the Area was intruded by ultrabasic rock, most of which was altered to serpentine. Soon thereafter a sequence of granitic-type rocks was emplaced on a major scale, beginning with the more basic gabbrodiorite and followed by the more acid granodiorite. At that time slopes in the Area were alined more gently westward than they are today. The crest of the Sierra Nevada, however, was approximately in its present location. Then the surface of the folded sedimentary and volcanic rock was lowered throughout by a long period of erosion, and large areas of the granitic batholith became exposed.

The volcanic activity began in the Sierra Nevada in the late Eocene period. Rhyolitic ash fell at the lower elevations, and, at the higher elevations, both flows and ash falls were deposited. These ash falls and flows formed the Valley Springs formation. This choked the stream channels, and the drainage system was completely changed. After the rhyolitic emissions, the volcanoes began to discharge andesitic material, mostly mud flows, dust, and lava flows. These flows formed the Mehrten formation. A volcanic plain then formed that again choked the streams, and new drainageways formed. The geologic activity of this time marked the beginning of the present land forms and had a strong influence in forming the soil patterns in the Area.

In early Pleistocene times, a major uplift of the Sierra Nevada Range was caused by faulting along the Range's east flank. The western slope was uniformly tilted upwards. Then the west-flowing rivers and streams in the newly uplifted area removed much of the volcanic debris and cut deep canyons into the underlying material, leaving long, tabular, volcanic ridges and exposures of Tertiary river gravel, rhyolitic tuff, and granitic and metamorphic rock.

Factors of Soil Formation

Soil has been defined as a natural formation on the surface of the earth in which plants grow; it is composed of organic sand mineral materials (*11*). Soils differ in their appearance, composition, management requirements, and productivity in different localities, or even within very short distances in the same locality. The factors that cause soils to differ are: relief, or lay of the land, and drainage; physical and mineralogical composition of the parent material of the soil; climate under which the soil material has accumulated; biological activity, including plant and animal life in and on the soil; and length of time the forces of formation have acted on the soil material. Each soil is affected by all five factors, but the relative effect and importance of each varies from one soil to another.

Relief and drainage

Present-day relief and drainage consists of deeply entrenched streams that flow in a general southwest-

ward direction. The deep canyons are V-shaped. The remnant ridges of andesite are tabular and have a slight west-facing slope. Areas of metamorphic rock are complex and steep and have many narrow ridges that lie in a dendritic drainage pattern. The topography is less rugged in the foothills. Areas of gabbrodiorite and granodiorite are smooth and rounded. Some of the granodiorite areas have the appearance of being in a basin because they are rimmed by more resistant metamorphic rock. A few alluvial bottoms and terraces are along streams of the present-day and Tertiary periods.

Most of these areas have been mined for gold.

Parent material

Parent material exerts one of the strongest influences on soil formation in the Nevada County Area. Most of the soils are on uplands and formed in place in metamorphic rock, sedimentary rock, granitic rock, or andesitic conglomerate (fig. 15). Specifically, the soils of the Area and their parent material are these:

Type of parent material	*Soil series or land type name*
Stratified mixed alluvium (recent)	Loamy and clayey alluvium
Stratified mixed alluvium (Tertiary river gravels)	Horseshoe
Andesitic conglomerate (Mehrten formation)	Ailken, Cohasset, Iron Mountain, Josephine, McCarthy
Granodiorite	Ahwahnee, Auberry, Chaix, Hoda, Hotaw, Musick, Sierra, Shenadoah, Trabuco
Gabbrodiorite	Boomer, Chaix variant, Secca, Sites
Serpentine	Dubakella, Dubakella variant
Slate (Mariposa group)	Mariposa, Josephine
Metamorphosed volcanic rock, greenstone, amphibolite schist	Auburn, Argonaut, Boomer, Cohasset, Josephine, Rescue, Secca, Sobrante, Sites
Slates and Schists (Calaveras group)	Mariposo, Maymen, Sites, Josephine

Metamorphic rock is generally not easily weathered. It mostly forms shallow, gravelly soils that contain many rock outcrops. Metamorphic and sedimentary rock are fine grained and form soils that have a surface layer of loam or silt loam. Some of these soils are low in fertility, probably because the sediment from which these rocks formed had been weathered in an earlier erosion cycle. For example, the Josephine soils are not so fertile as the adjacent Cohasset soils, which formed in material from andesitic rock. At the lower elevations amphibolite schist and greenstone form the Auburn soils. The Auburn soils are shallow loam and have many rock outcrops. The Calaveras and Mariposa formation are folded so that they are tilted nearly vertically. The bedding planes of the metasedimentary schists and slates are exposed at the surface of these formations. The variability in composition of this stratification is reflected in the variation of soils within short distances. Depth and other characteristics of the soil change rapidly. Examples are Mariposa, Josephine, and Sites soils.

Among the soils on andesitic conglomerate are those of the Aiken and Cohasset series. The andesitic conglomerate is deeply weathered, especially in the Aiken soils, because this material is porous and weathers easily. The andesite is moderately fine grained and forms soils that have a surface layer of loam or sandy loam. A shallow soil that formed on this parent material is the Iron Mountain soil.

Soils underlain by granitic rock are present in places where the overlying rocks were stripped away and the Sierra Nevada batholith exposed. In these places are soils of the Sierra, Chaix, Musick, Hoda, Hotaw, Auberry, and Ahwahnee series. The parent rock is weathered to a considerable depth, and the soils are 2 to more than 5 feet deep. The weathered rocks contain many angular, coarse grains of sand, mostly quartz, which form soils that have a surface layer of sandy loam. The abrasive action of the grains of sandy material carried by runoff accounts for the susceptibility of these soils to erosion. The rounded topography and the depth of the soils indicate that geologic erosion also is relatively rapid.

Narrow bands of ultrabasic rock, mostly serpentine, underlie some areas. The ultrabasic rock contains large amounts of magnesium in relation to calcium. The Dubakella soils, which exemplify this, are very low in fertility as a result.

The relationship of parent material to soil patterns can be seen on the general soil map at the back of this survey. The main difference between groups of soil associations is parent material, and many of the soil boundaries are closely related to the boundaries of the geologic formations.

Climate

Climate has a marked influence on soil formation. Heat and moisture strongly influence the kind and amount of vegetation that grows, the rates at which organic matter decomposes, minerals weather, material is removed from some horizons, and material in other horizons accumulates.

Temperature and precipitation in the Area vary with elevation. In the western part of the Area, near the Yuba County line, the elevation generally ranges from 300 to 800 feet, the precipitation is 26 to 30 inches, and the mean annual temperature is about 60° F. The precipitation increases and the temperature decreases regularly with the increase in elevation. At an elevation of about 4,500 feet, the annual precipitation is 50 to 60 inches and the mean annual temperature is about 55° F. Above 3,000 feet, a significant amount of precipitation falls as snow.

Summers in the Area are hot and dry, and winters are cool and moist. Rainfall in summer is insignificant except for a few thundershowers in the higher mountains. Significant rainfall generally begins early in fall, reaches a maximum in midwinter, and ends late in spring.

The content of organic matter in the soils is greatest at high elevations where the climate is cool and moist. At elevations of more than 4,500 feet, growth is

Figure 15.—In this road-cut area andesitic tuff of the Mehrten Formation is over rhyolitic tuff of the Valley Springs Formation.

not so rapid as at lower elevations, because of cool temperatures and a short growing season. Nevertheless, these soils are high in organic matter because the roots of the plants are generally coarse and the cool temperatures do not favor rapid decomposition. At intermediate elevations the soils have a moderate amount of organic matter even though decomposition is rapid. The rainfall is abundant and the temperature is moderate. The vegetation is abundant, and a large amount of plant residue is returned to the soil. At lower elevations the soils have a low amount of organic matter. The vegetation consists mostly of annual grasses and forbs. Even though the soils are dry in summer and early in fall, the warm and moist weather in spring and late in fall favors rapid decomposition of the very fine grass roots.

The trend of increasing content of organic matter with increasing elevation and decreasing temperature probably reverses itself at elevations above those in the survey area.

Rainfall in the Area is sufficient to leach the soils of lime and other water-soluble material. In places, surplus water accumulates in the soil during the wetter seasons. The surplus water is retained by the soil, percolates through it, or is lost through runoff. Surface runoff, however, does not cause a major loss of water in the Area. Thus, even at low elevations enough rain falls to leach the soils of carbonates and soluble salts. Evidences of leaching are the absence of lime in practically all profiles, the presence of clay films at considerable depths in many of the soils or in the weathered rock, and the constant or decreasing reaction of the soil with depth.

Between elevations of 1,800 and 1,700 feet, the soils appear to undergo the most intensive weathering, because they are still moist when they warm in the summer. In general, soils at these elevations have a thicker profile and a redder, finer-textured Bt horizon than those at higher or lower elevations. Lack of moisture when the soils are warm limits the rate of weathering. On the other hand, cooler temperatures at high elevations along the eastern boundary of the Area slow chemical reactions and limit weathering.

The Argonaut and Shenandoah soils are exceptions. The Argonaut soils are present at the lower elevations, but they have clay Bt horizons associated with rapid weathering. This is caused by translocation of some clay from the A horizon to the B horizon, and by the fact that these soils formed on relatively massive rocks where slopes are gentle and commonly concave. The bedrock is impermeable, and the topography such that water is trapped above the bedrock. These soils stay moist longer in summer and the rock weathers in place to clay.

Biological activity

The vegetation from the western boundary of the Area eastward consists progressively of grass, oak and grass intermingled in places with brush, areas of oak and grass transitional to coniferous forest, and coniferous forest. The pattern of vegetation has been changed somewhat because of fires, grazing practices, clearing, and short periods of cultivation.

Soils formed under grass and oak and grass have a thin A horizon about 3 to 9 inches in thickness and contain relatively low amounts of organic matter. Most of these soils have been used for grazing for more than a hundred years. The amount of plant residue left after grazing each year varies greatly according to grazing practices and seasonal growth. Under average grazing methods, yearly additions of organic residue to the soils are estimated to be between 400 and 1,500 pounds per acre of stems and leaves and an equivalent weight of roots. Thus, about 800 to 3,000 pounds of organic matter are returned to the soil each year, mostly to the A horizon. Most soils contain between 1 and 2 percent organic matter in the A horizon; thus, between 30,000 and 60,000 pounds would accumulate in the upper 9 inches of soils in 20 to 40 years if no decomposition occurred. As evidence indicates that the organic-matter content of the soil is increasing, it is assumed that micro-organisms decompose the annual additions of organic matter.

Near Wolf Mountain some Secca soils are under extensive areas of brush. These soils are susceptible to erosion because brush, which has few fine surface roots, does not adequately protect the soil even though the overstory is thick. Furthermore, grass does not grow well under brush. Erosion consequently is active under the brush and has left a gravel pavement and exposed rock outcrop over much of this area. Also, additions of organic matter to the soils are low. The relatively coarse roots probably account for a carbon-nitrogen ratio of 15 to 18 or more, high in comparison to the ratio of less than 15 to 1 of soils under grass.

Soils in the transition zone between areas of oak and grass and areas of coniferous forest have an A horizon that is somewhat thicker and higher in content of organic matter than the same soils at lower elevations. Here changes in vegetation have occurred in places because of fires or minor fluctuations in climate.

The soils formed under coniferous forest have a mat of litter and duff from ½ inch to more than 6 inches thick. Such material is acid and contributes to the acidity of the soils. Tree roots follow cracks and fracture planes in the parent rock and help to break up the rocks. In places, roots in the upper 2 or 3 feet of the soil make up more than 20 percent of the total volume of soil material, and their growth and decomposition make the soil more porous. In soils formed under forest, the carbon-nitrogen ratio is more than 20 to 1.

Burning also has influenced the soils in many ways. The main causes of fire are man's carelessness and lightning. Repeated burning depletes organic matter and thus influences the characteristics of the surface layer. Fire also changes plant ecology, resulting in different plant communities. In this way one of the soil-forming factors becomes altered.

Time

The geologic age of the parent rock does not necessarily relate to the age of the soils. None of the soils in the Area show signs of being old. This is probably because, on the natural slopes, the geologic erosion progresses at about the same rate as the formation of soil.

The oldest soils in the Area are those in relatively undissected tracts, and the youngest are those on narrow steep divides, on very steeply sloping areas, or other areas subject to erosion. The Aiken soils formed on remnants of the volcanic plain as tabular ridges and are considered to be the oldest soils. Other soil materials were exposed after the volcanic plains were dissected or stripped away by erosion, and their soils are thus more youthful. An example of the sequence of soil formation in the Area is illustrated by Maymen, Mariposa, Josephine, and Sites soils. The Maymen soils are on narrow ridge crests or adjacent steep side slopes. These soils are shallow to hard bedrock and lack a B2t horizon. The Mariposa soils are on broader divides and less erodible side slopes than the Maymen soils. They are shallow to moderately deep and have a weak B2t horizon. The Josephine soils are in areas where slopes are long and stable or in lower areas on gently sloping divides. They are deep and have a distinct B2t horizon of silty clay loam. The Sites soils are in the most stable positions of the landscape and have a B2t horizon of red clay. In places differences in these soils, however, are related to the ease of weatherability of the stratified parent rock. Moisture and temperature also account for some of these differences.

Soil-Forming Processes and Morphology

Because the influence of the soil-forming factors varies greatly within the survey area, many different kinds of soils have formed. Many soils in the Area have several prominent horizons; some have only one horizon, and others have several weak horizons. In places soils that have prominent horizons are adjacent to those that have less distinct horizons. The processes that have had the greatest influence in horizon formation are the weathering of parent materials, the accumulation of organic matter, the formation and translocation of clays, and the influence of iron oxides.

Some of the distinguishing features of the soils formed from bedrock are related to the degree to which the parent material has weathered. For example, where weathering has been slight, the soils have few horizons and, generally, distinguishing features that come from their parent material. As weathering increases, horizon differences are less directly related to the parent material and are more the products of alteration. The deep Aiken soils have a red clay Bt horizon and other horizons that contrast sharply with the underlying brownish-yellow andesitic conglomerate.

In all soils of the Area, enough organic matter has accumulated on the surface to form an A1 horizon.

This A1 horizon ranges from a thin, faint horizon, pale in color, to a thick, conspicuous horizon, dark in color. At the lower elevations the soils have an A1 horizon about 3 to 8 inches thick that is about 2 percent or less organic matter. Organic matter does not accumulate in large quantities because of warm temperatures. In the eastern part of the Area, cooler temperatures prevail, and so the A1 horizon is thicker, darker, and higher in organic matter. The Aiken soils have a thick, dark A1 horizon that is about 6 percent organic matter in the upper 15 inches.

The translocation of silicate clay minerals has taken place in many soils in the Area. The clay films on ped faces and in root channels, as well as colloidal bridges between the sand grains, indicate the movement of clay minerals from the A horizon to the B2t horizon. Auburn soils have little or no translocated clay. Musick soils have a large amount of translocated clay, as 20 percent more clay is in the B2t horizon than in the A1 horizon. Another evidence of the translocation of clay is the many thick clay films in the Bt horizon.

Iron affects the color of many soils. In well-drained soils, iron is oxidized and produces yellow and red colors. Where the iron has been translocated in the profile, the colors are more intense. Aiken, Musick, and Sites soils are examples. The translocation of iron is greatest in soils at elevations from 2,000 to 4,000 feet. Here the temperature favors a high degree of weathering and a considerable amount of water percolates through the soil. Forest litter on the surface produces organic acids that help to release iron for downward migration. This increase is indicated in the redder color of the B2t horizon in such soils as those of the Aiken and Sites series. The reduction of iron is not an important process in the Area, but it does happen in poorly drained soils like Alluvial land, clayey. This process, called gleying, gives rise to black, gray, and blue-green colors.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and revised later (*8*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties and adopted in 1965. It is under continual study (*7, 10*).

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 8 shows the classification of each soil series of the Nevada County Area by family, subgroup, and order, according to the current system. Soils of the Area are in three orders: Alfisols, Inceptisols, and Ultisols, which are discussed in the following pages.

Alfisols are soils with ochric epipedons and argillic horizons. Generally, these soils have a base saturation of more than 35 percent. All the Alfisols in this Area are seasonally dry for 60 or more consecutive days in most years and, with the exception of Shenandoah soils, do not have a 15 percent clay increase within 1 inch of the upper boundary of the argillic horizon. Many of the Alfisols in the Area have some properties that are similar to Mollisols and Ultisols.

The Ahwahnee, Argonaut, Rescue, Secca, Sobrante, Dubakella, and Trabuco soils have ochric epipedons and some properties of Mollisols as a result of having a slightly darker A horizon than Typic Haploxeralfs. To a depth of 4 inches, these soils have a moist value darker than 3.5 or are more than 1 percent organic matter. The laboratory data for the Secca and Trabuco soils are given in table 9. These data show that the content of organic carbon, to a depth of 4 inches, is high enough to be equivalent to more than 1 percent of the organic matter. These soils are classified in the subgroup Mollic Haploxeralfs.

These soils differ at the family and series level. The Ahwahnee soils have coarse-loamy, argillic horizons. The Argonaut, Secca, and Trabuco soils have fine, argillic horizons, but differ at the series level. The Dubakella soils are in the family of clayey soils. The Rescue and Sobrante soils have fine loamy, argillic horizons, but they also differ at the series level. The Argonaut series consists of shallow to moderately deep soils that formed on metabasic rock.

The Hoda, Cohasset, Musick, Hotaw, and Boomer soils are at higher elevations and under conditions of higher rainfall than the other Alfisols in the Area. This additional rainfall has leached more of the bases from the soil so that, in places, the argillic horizons have a base saturation of less than 75 percent. These data are shown in table 9, and confirmed in the sampling of the Hoda soils and the laboratory data. These soils have a base saturation in the epipedon of slightly more than 50 percent, but soils nearby and at slightly higher elevations no doubt have base saturation of less than 50 percent. The Hoda soils have an umbric epipedon. Other soils in this subgroup have ochric epipedons. Although not present at higher elevations and under conditions of higher rainfall, Auberry and Sierra soils have a base saturation of less than 75 percent in parts of the argillic horizon. All of these soils are classified as Ultic Haploxeralfs.

The Dubakella variant has a lithic contact within a depth of 20 inches and is classified as a Lithic Haploxeralf.

TABLE 8.—*Classification of soil series into higher categories*

Series	Family	Subgroup	Order
Ahwahnee	Coarse-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Aiken	Clayey, kaolinitic, mesic	Xeric Haplohumults	Ultisols.
Argonaut	Fine, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Auberry	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Auburn	Loamy, mixed, thermic	Ruptic-Lithic Xerochrepts	Inceptisols.
Boomer	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Chaix	Coarse-loamy, mixed, mesic	Dystric Xerochrepts	Inceptisols.
Chaix, thick solum variant	Fine-loamy, mixed, mesic	Typic Xerochrepts	Inceptisols.
Cohasset	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Dubakella	Clayey-skeletal, serpentinitic, mesic	Mollic Haploxeralfs	Alfisols.
Dubakella, shallow variant	Clayey, serpentinitic, thermic	Lithic Haploxeralfs	Alfisols.
Hoda	Fine, kaolinitic, mesic	Ultic Haploxeralfs	Alfisols.
Horseshoe	Fine-loamy, mixed, mesic	Xeric Haplohumults	Ultisols.
Hotaw	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Iron Mountain	Medial, mesic	Lithic-Mollic Vitrandepts	Inceptisols.
Josephine	Fine-loamy, mixed, mesic	Typic Haploxerults	Ultisols.
Mariposa	Fine-loamy, mixed, mesic	Ruptic-Lithic-Xerochreptic Haploxerults.	Ultisols.
Maymen	Loamy, mixed, mesic	Dystric Lithic Xerochrepts	Inceptisols.
McCarthy [1]	Medial-skeletal, mesic	Typic Vitrandepts	Inceptisols.
Musick	Fine-loamy, mixed, mesic	Ultic Haploxeralfs	Alfisols.
Rescue	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Secca	Fine, mixed, mesic	Mollic Haploxeralfs	Alfisols.
Shenandoah	Fine, montmorillonitic, thermic	Aquic Palexeralfs	Alfisols.
Sierra	Fine-loamy, mixed, thermic	Ultic Haploxeralfs	Alfisols.
Sites	Clayey, kaolinitic, mesic	Xeric Haplohumults	Ultisols.
Sobrante	Fine-loamy, mixed, thermic	Mollic Haploxeralfs	Alfisols.
Trabuco	Fine, mixed, thermic	Mollic Haploxeralfs	Alfisols.

[1] Mapping unit MnE lacks the cobblestones that are characteristic of the series.

The Shenandoah soils have fine, argillic horizons that have an abrupt boundary between the A and B horizons and a 15 percent increase in clay within 1 inch of the upper boundary of the argillic horizon. In some portions they have a base saturation of at least 75 percent. These soils also have mottles with chroma of 2 or less within a depth of 30 inches, and a surface layer colored almost like those in Mollisols. Shenandoah soils are classified as Aquic Palexeralfs.

Inceptisols have one or more diagnostic horizons. They do not have significant horizons of eluviation or illuviation.

The Auburn, Chaix variant, Iron Mountain, McCarthy, Maymen, and Chaix soils are Inceptisols. The Auburn soils are shallow, loam to clay loam soils that formed on hard metamorphic rock. They have pale ochric epipedons and yellowish-red cambic horizons that are interrupted by ledges of bedrock. A lithic contact to hard rock is present within a depth of 20 inches in some pedons. These soils are seasonally dry for more than 60 consecutive days in most years. Auburn soils are classified in the subgroup Ruptic-Lithic Xerochrepts.

The McCarthy soils have a dark-colored surface layer that has a base saturation of less than 50 percent. The surface layer is classified as an umbric epipedon. The McCarthy soils have strong-brown cambic horizons. They are seasonally dry for more than 60 consecutive days in most years and have a high percentage of vitric ash. McCarthy soils are classified in the subgroup Typic Vitrandepts.

Chaix soils have pale ochric epipedons, a paralithic contact between depths of 20 and 40 inches, and cambic horizons. They are seasonally dry for more than 60 consecutive days in most years and have a base saturation of less than 60 percent within a depth of 30 inches. Chaix variant soils have a base saturation of more than 60 percent within a depth of 30 inches.

Maymen soils have ochric epipedons and cambic horizons that have a base saturation of less than 60 percent within a depth of 30 inches. The cambic horizons are the same in hue as the epipedon. Maymen soils have a lithic contact within a depth of 20 inches.

The Iron Mountain soils have a mollic epipedon and are seasonally dry for more than 60 consecutive days in most years. They also have a lithic contact within a depth of 20 inches and have large amounts of vitric ash.

Ultisols are highly weathered soils that formed under a humid climate. They have argillic horizons. The base saturation generally is less than 35 percent. In this Area, all Ultisols are seasonally dry for 60 consecutive days or more between depths of 10 to 40 inches in most years.

The Aiken soils are considered the oldest soils in the Area. They have thick, dark, umbric epipedons. The argillic horizons are more than 50 inches thick, and in the upper 40 inches of the argillic horizons, more than 10 percent of the soil consists of weatherable minerals in the 20- to 200-micron fraction. The upper 6 inches of the argillic horizons also contain more than 1.5 percent organic matter. The Aiken soils are classified in the subgroup Xeric Haplohumults. Other Xeric Haplohumults are the Horseshoe and Sites soils. They have

ochric epipedons and the characteristics listed above for Aiken soils, but Horseshoe and Cohasset soils have fine-loamy, argillic horizons.

The Mariposa soils are less than 1.5 percent organic matter in the upper 6 inches of the argillic horizon and have a lithic contact within a depth of 20 inches in part of each pedon. The argillic horizon is not continuous in each pedon. Mariposa soils are classified as Ruptic-Lithic-Xerochreptic Haploxerults.

Laboratory Analyses

Five of the important soils in the Nevada County Area were sampled for laboratory analyses. They are Hoda sandy loam, Dubakella gravelly loam, Secca gravelly silt loam, Sites loam, and Trabuco loam. The soil types that are footnoted in table 9 are the modal type for the series in the Area.

Additional laboratory analyses on the Ahwahnee, Aiken, Argonaut, Auburn, Josephine, Mariposa, Musick, Sierra, and Sites soils can be found in the soil survey of Amador Area, California.

All samples were collected from pits. Fragments larger than ¾ inch were discarded. The samples were crushed and passed through a 2-millimeter round-hole screen. All data are on soil material that passed through the screen. The results are expressed on an ovendry basis. Empty columns and lines indicate that the determination was not made for that soil.

The following procedures are taken from Soil Survey Investigations Report No. 1 (*12*) and Diagnosis and Improvement of Saline and Alkali Soils (*9*). The procedure or method used is identified by numbers and letters in parentheses. An example is (3A1) for particle-size distribution.

Particle-size distribution.—Pipette method. Dispersion with sodium hexametaphosphate and mechanical shaking. (3A1)

Organic carbon.—Acid dichromate digestion. (6A1a)

Nitrogen.—Ammonia distillation. (6B1a)

C/N ratio.—$\frac{\text{Organic carbon}}{\text{nitrogen}}$.

Extractable iron.—Dithionite-citrate extraction. (6C2a)

Bulk density (dry).—Saran dipped clods. (4A1h)

Moisture held at 15 bar.—Pressure membrane extraction. (4B2)

COLE and COLEf.—Linear extensibility expressed in percent, or COLE and COLEf × 100. (4D1)

Reaction (pH).—Glass electrode. Soil suspensions 1:1 dilution. (8C1a)

Extractable bases.—NH_4OAc extraction (exchangeable cations in nonsaline, noncalcareous soils). Displacement with 1N NH_4OAc.—Ca^{++} by titration, Mg^{++} gravimetrically, Na^{+} and K^{+} by flame photometry. (5B1c)

Sum of bases.—$Ca^{++} + Mg^{++} + Na^{+} + K^{+}$.

Cation exchange capacity (CEC).—Na^{+} saturation, displacement with NH_4OAc and determination of Na^{+} displaced. (5A1a)

Cation exchange capacity (CEC), sum of cations.—Sum of bases (extractable bases) + extractable acidity. (5A3a)

Extractable acidity.—$BaCl_2$ – triethanolamine II method. Back-titration with HCL. (6H2a)

Base saturation (NH_4OAc).—

$$\frac{\text{Sum of extractable bases (Ca, Mg, Na, K) meq. 100 g. soil}}{\text{exchange capacity determined by method 5A1 } (NH_4OAc)} \times 100. \text{ (5C1)}$$

Base saturation (sum of cations).—

$$\frac{\text{Sum of extractable bases (Ca, Mg, Na, K) meq./100 g. soil}}{\text{Sum of extractable cations (Ca, Mg, Na, K, H) meq./100 g. soil}} \times 100. \text{ (15C3)}$$

General Nature of the Area

The physiography, relief, and drainage of the Nevada County Area are discussed in this section, and facts are given about the climate, the water supply, and land ownership. Also discussed are development and population, history, industry, transportation, minerals and mining, tourism and recreation, and farming.

Physiography, Relief, and Drainage

The Nevada County Area is entirely in the lower and middle foothills and lower portions of the Sierra Nevada mountain range. No part of the Area is in the Great Valley of California. The part of the Area in the Sierra Nevada is dominated by steeply dipping, faulted, and folded metamorphic rock that has been intruded by several types of igneous rock. Overlying the bedrock in many places are mantles of river gravel and volcanic debris.

The ascent from the Great Valley through the lower and middle foothills is gentle, and the average slope through the west-to-east transect is about 3 to 3½ percent. In general, the trend of rock formation is northwest to southeast. Drainage generally is toward the southwest, and drainage channels cut through geological formations, following the westward tilt of the Sierra fault block. The upper parts of the major streams and rivers are more deeply gouged by river canyons and drainageways than the more rolling foothills, where cutting is less. Generally, the folded and faulted areas of metasedimentary rock are steep and angular, the granitic areas are rounded and smooth, and areas capped with volcanic conglomerate are flat topped and smooth.

The area is drained mostly by the Bear River to the south and the South and Middle Yuba Rivers to the north. These rivers, in turn, flow into the Feather River, then the Sacramento River, and finally the San Francisco Bay and the Pacific Ocean. Greenhorn

TABLE 9.—*Laboratory*

[Analyses by Soil Survey Laboratory, Riverside, California. Absence of information

Soil name and sample number	Depth from surface	Horizon	Size class and diameter of particles									Organic matter		
			Very coarse sand (2 mm.-1 mm.)	Coarse sand (1 mm.-0.5 mm.)	Medium sand (0.5 mm.-0.25 mm.)	Fine sand (0.25 mm.-0.10 mm.)	Very fine sand (0.10 mm.-0.05 mm.)	Silt (0.05 mm.-0.002 mm.)	Clay (less than 0.002 mm.)	Fine silt (0.02 mm.-0.002 mm.)	Coarse fragments greater than 2 mm.	Organic carbon	Nitrogen	Carbon-nitrogen ratio
	In.		*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	
Hoda sandy loam [1] (S68-California-29-33).	0–4	A11	16.4	19.2	9.2	13.8	8.4	25.5	7.5	14.4	10	2.03	0.093	22
	4–12	A12	8.9	13.4	8.2	13.4	8.3	32.5	15.3	20.3	10	1.35	0.056	24
	12–18	B1t	11.2	11.2	5.9	10.0	6.1	36.8	18.8	26.2	8	0.55	0.036	15
	18–36	B21t	6.3	7.7	3.9	6.6	5.5	25.2	44.8	17.9	6	0.35	------	------
	36–46	B22t	6.8	8.1	4.1	8.6	6.3	21.4	44.7	15.1	3	0.17	------	------
	46–53	B31t	9.9	16.2	7.7	12.4	6.7	17.6	29.5	11.7	3	------	------	------
	53–63	B32t	8.5	14.9	7.5	14.1	8.6	22.1	24.3	13.5	7	------	------	------
Dubakella gravelly loam (S68-California-29-36).	0–2	A11	6.6	10.8	8.3	19.4	15.2	30.9	8.8	11.7	22	1.58	0.073	22
	2–6	A12	6.7	10.0	7.6	16.9	15.1	33.4	10.3	14.1	7	0.62	0.031	20
	6–16	B2t	2.3	5.3	4.5	10.4	7.7	30.2	39.6	17.9	6	0.33	0.031	11
	16–26	C	3.2	7.3	6.1	13.1	7.9	28.8	33.6	19.3	12	0.2	------	------
Secca gravely silt loam [1] (S68-California-29-7).	0–6	A1	2.4	3.9	2.8	6.6	7.8	58.8	17.7	40.1	61	1.50	0.050	30
	6–15	A3	2.2	2.8	2.2	5.1	6.5	57.4	23.8	41.8	59	0.71	0.045	16
	15–22	B1t	2.7	3.5	2.0	4.2	5.3	50.7	31.6	37.2	45	0.64	------	------
	22–36	B2t	1.0	1.1	1.2	3.0	3.7	29.5	60.5	22.1	41	0.23	------	------
	36–45	B3t	3.8	4.8	2.8	6.1	4.9	35.3	42.3	29.2	35	------	------	------
Sites loam (S68-California-29-7).	0–7	A11	2.7	5.3	3.0	5.9	5.1	45.2	32.8	31.2	--------	6.00	0.249	24
	7–21	A12	1.8	4.1	3.1	5.9	5.4	45.1	34.6	30.5	6	1.72	0.085	20
	21–31	A3	1.5	3.7	3.0	6.0	6.6	43.4	35.8	30.2	6	1.07	------	------
	31–40	B1t	0.9	3.0	2.9	5.8	6.2	38.5	42.5	26.9	3	0.51	------	------
	40–52	B21t	1.5	3.1	2.8	6.2	6.1	34.9	45.4	23.2	--------	0.38	------	------
	52–64	B22t	1.3	3.8	3.6	7.9	7.5	32.8	43.1	22.0	2	0.30	------	------
	64–75	B31	1.0	3.9	4.4	9.8	8.2	31.4	41.3	20.8	--------	0.22	------	------
	75–85	B32	1.9	6.8	5.7	10.9	8.7	29.9	36.1	19.7	--------	------	------	------
Trabuco loam [1] (S68-California-29-29).	0–4	Ap1	2.5	7.6	7.5	14.4	6.1	40.4	21.5	25.7	--------	2.55	0.198	13
	4–10	A12	1.9	7.2	7.1	13.9	7.4	38.0	24.5	24.4	--------	0.73	0.068	11
	10–15	B1	1.5	6.3	6.2	11.9	7.3	35.4	31.4	24.3	--------	0.44	------	------
	15–29	B21t	0.5	4.4	4.7	8.8	5.0	27.3	49.3	19.2	--------	0.29	------	------
	29–40	B22t	1.1	4.7	4.1	8.6	6.3	31.8	43.4	23.0	--------	0.20	------	------
	40–55	B31t	2.5	7.0	5.0	11.5	9.4	32.9	31.7	21.9	--------	0.14	------	------
	55–67	B32t	2.6	8.1	5.4	12.8	9.6	33.4	28.1	22.7	--------	------	------	------

[1] Modal.

Creek, Wolf Creek, Dry Creek, and Rock Creek are other streams that drain the Area. All are tributary to the Bear River. These creeks are perennial; but after a succession of years when rainfall is below average, their flow is reduced in summer. Numerous other minor drainageways are tributary to these rivers and creeks.

Climate [5]

The Nevada County Area generally has warm, dry summers and mild, wet winters. Occasionally, however, thundershowers occur in summer at the higher elevations. Also, temperatures of more than 100° F. occur nearly every year, and sometimes temperatures drop well below freezing in winter. Most of the precipitation comes during the six months of winter, the seasonal total ranging from 26 inches at the lower elevations to almost 60 inches at the higher elevations. In the lower foothills, little snow falls; but at higher elevations the amount of snowfall is fairly large. In general, temperature decreases with an increase in altitude, but in low, sheltered areas cold air tends to accumulate. The amount of precipitation generally increases with an increase in elevation. Most of the precipitation in winter falls when a southwest wind is

[5] By C. ROBERT ELFORD, climatologist, State of California, National Weather Service, U.S. Department of Commerce.

analyses of representative soils

indicates that a quantity of less than the minimum reportable value was detected]

Extractable iron	Bulk density	Moisture held at tension of 15 atmospheres	Coefficient of linear extensibility		Reaction (1:1)	Extractable bases				Sum of bases	Cation-exchange capacity		Extractable acidity	Base saturation	
			COLE	COLEf		Ca	Mg	Na	K		NH_4OAc	Sum		NH_4OAc	Sum of extractable cations
Pct.	*Gm./cc.*	*Pct.*	*Pct.*	*Pct.*	*pH*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*	*Meq./100 gms.*
2.4	1.24	7.3	0.3	0.3	5.8	3.4	0.8	------	0.5	4.7	11.1	13.9	9.2	42	34
2.9	--------	9.6	--------	--------	5.3	1.6	0.6	0.1	0.5	2.8	10.7	13.4	10.6	26	20
3.6	--------	11.4	--------	--------	5.2	2.4	1.1	0.1	0.5	4.1	9.5	8.3	4.2	43	49
5.2	--------	19.3	--------	--------	5.5	3.5	1.9	------	0.6	6.0	11.7	19.6	13.6	51	30
5.5	1.33	21.1	1.6	1.5	5.5	3.0	1.8	0.1	0.5	5.4	10.6	17.4	12.0	50	31
3.7	--------	14.5	--------	--------	5.4	2.0	1.1	------	0.5	3.6	9.8	8.7	5.1	37	41
3.8	1.25	13.8	0.3	0.3	5.4	1.7	1.0	0.1	0.5	3.3	10.5	8.0	4.7	31	41
2.7	1.58	7.2	0.9	0.7	5.8	3.6	8.1	------	0.2	11.9	15.3	16.6	4.7	79	--------
2.9	1.54	7.2	1.6	1.5	5.9	1.6	9.7	------	0.1	11.4	13.2	--------	--------	86	--------
3.1	1.38	23.8	10.2	9.9	6.1	1.3	43.1	0.1	------	44.5	37.9	--------	--------	117	--------
2.7	0.86	27.8	4.2	4.0	6.8	1.5	44.8	0.1	------	46.4	41.7	--------	--------	111	--------
4.9	0.97	11.0	--------	--------	6.2	10.4	6.8	0.1	0.2	17.5	20.8	25.4	7.9	84	68
5.5	1.32	12.6	2.7	1.6	6.4	9.9	7.9	0.1	0.1	18.0	20.9	23.6	5.6	86	76
6.0	1.45	14.9	2.2	1.5	6.3	10.2	10.7	0.1	0.1	21.1	23.5	27.5	6.4	89	76
5.3	1.79	24.7	10.7	7.5	6.6	16.3	20.1	0.2	0.2	36.8	36.4	--------	--------	101	--------
3.3	1.27	25.6	9.0	7.3	6.7	17.3	20.8	0.3	0.1	38.5	40.6	--------	--------	94	--------
9.2	0.94	23.5	1.5	1.5	5.9	9.9	2.7	0.1	1.0	13.7	31.8	--------	--------	43	--------
9.8	--------	21.1	--------	--------	5.9	3.4	1.5	0.1	1.0	6.0	17.4	--------	--------	34	--------
9.7	--------	20.9	--------	--------	5.7	2.8	1.8	0.1	0.6	5.3	17.7	18.0	12.7	29	29
9.9	--------	20.3	--------	--------	5.5	2.1	2.3	------	0.6	5.0	13.3	--------	--------	37	--------
10.5	--------	21.3	--------	--------	5.4	2.8	2.0	0.1	0.5	5.4	11.2	--------	--------	48	--------
12.6	1.24	24.3	2.0	1.9	5.2	2.9	1.8	0.1	0.4	5.2	13.0	--------	--------	39	--------
12.6	--------	26.2	--------	--------	5.2	3.1	2.1	0.1	0.4	5.7	12.4	--------	--------	45	--------
12.4	1.22	24.8	1.4	1.4	5.1	2.9	2.2	------	0.4	5.5	18.9	--------	--------	29	--------
3.4	1.50	10.6	1.1	1.1	5.7	9.4	2.9	0.1	0.5	12.9	18.1	20.5	7.6	71	42
3.8	1.53	10.4	1.3	1.3	5.9	7.5	2.7	0.1	0.3	10.6	14.5	--------	--------	73	--------
4.2	1.63	13.4	2.1	2.1	6.0	8.1	4.1	0.1	0.2	12.5	16.7	--------	--------	74	--------
4.9	1.63	20.1	4.0	4.0	6.0	10.8	7.0	0.1	0.1	18.0	22.6	--------	--------	79	--------
4.4	1.61	22.2	4.8	4.8	6.1	13.8	11.2	0.1	0.1	25.2	27.6	--------	--------	91	--------
--------	1.62	20.6	3.1	3.1	6.3	14.1	12.7	0.2	0.1	27.1	27.9	--------	--------	97	--------
3.2	1.64	18.8	3.2	3.2	6.3	17.2	15.0	0.2	0.1	32.5	27.7	--------	--------	117	--------

blowing. Estimates of weather conditions in the Area are based on data from weather offices of the National Weather Service in the Area, in other parts of Nevada County, and in surrounding counties.

The average annual temperature in the Nevada County Area ranges from about 60° F. at the lower elevations to about 55° at the higher elevations in the eastern part of the Area. Minimum temperatures are most affected by local variations in the terrain. The January average minimum temperature ranges from about 36° at the lower elevations to about 30° near North Bloomfield, at an elevation of about 4,500 feet.

Average maximum readings in July are in the 90's, and they range from about 92° F. at the higher elevations to nearly 98° at the lower elevations. The highest temperatures recorded are approximately 100° in the higher, eastern part of the Area, and 112° F. in the lower, western part. These and other temperature data are given in tables 10, 11, 12, and 13.

The growing season, which is the interval between the last freezing temperature in spring and the first in the fall, ranges from 140 to 265 days. The average date of the last freezing temperature in spring is about the middle of March in the lower areas and about the end of May in the higher areas. In the fall the average date of the first freezing temperature ranges from about November 10 in the upper parts of the area to the middle of November in lower areas.

Precipitation in the driest part of the Nevada County Area, the southwest corner, averages about 26 inches per year. In the higher eastern part of the Area, it averages about 55 to 60 inches per year. The total annual precipitation varies considerably from year to year. Precipitation probabilities are given in table 13.

The average annual snowfall is about 30 inches at elevations of 2,500 feet and about 55 inches in the higher, eastern part of the Area. At lower elevations, however, snowfall is infrequent and little accumulates.

The average maximum seasonal snow depth is 8 inches in Grass Valley and 11 inches in Nevada City. One year in five the maximum snow depth will be 18 inches in Grass Valley and 21 inches in Nevada City.

Most precipitation in the Area comes in the fall, winter, and spring; only a small amount falls in summer. The winter storms often cause heavy precipitation over the entire area; summer thundershowers, however, generally cover a limited area.

In general, prevailing wind in the Nevada County Area blows from a southwesterly direction most of the year and the windspeed averages less than 10 miles an hour. In summer, scattered thundershowers generally come from a south or southwesterly direction. At times they are accompanied by high winds. The winter storms generally come from a south or southwesterly direction also. In winter windspeed reaches 50 miles per hour every two years.

Winds from the north and east occasionally blow over the lower western slopes of the Sierra Nevada. In winter these winds bring cold, dry weather. In spring and summer, however, these winds are warm and dry. As a result they quickly remove moisture from the soil surface and dry out plants.

Relative humidity in the Nevada County Area is moderate most of the time (*14*). In winter the average relative humidity ranges from about 90 percent at night to about 70 percent during the day. In summer the average relative humidity ranges from 80 percent at night to 25 percent during the day. These generally low readings are caused by the downslope winds characteristic of the Area.

During the months of June through September, the sun shines more than 90 percent of the day, but in winter it shines only about 50 percent. The amount of sunshine received is generally the same throughout the Area, except that in summer more clouds are likely at the higher elevations.

Plant growth is related directly to the amount of moisture used by the plant. This characteristic provides a convenient basis for computing estimated plant growth under various conditions. It is possible to compute the accumulative amount of moisture a plant could use under the existing climate if adequate water were available and thus to estimate the potential growth of plants in a particular climate.

In the warmer part of the Nevada County Area, according to the Thornthwaite Method, a plant that grows all year could use about 36 inches of water. In places plants do not grow all year, however, because their growth is stopped by frost. As a result potential use of moisture by plants is about 35 inches in the warmer areas, but at high altitudes it is as low as 30 inches for the year and 25 inches for the growing season.

Where irrigation is not available, it is important to know potential plant development under dryfarmed conditions. Assuming that the soil is capable of storing 4 inches of available moisture in the root zone, which is a reasonable assumption for much of this Area, frost-tolerant crops growing all year would probably use 12 inches of moisture at low elevations and as much as 15 inches in the higher, eastern part of the Area. More moisture is available to plants during the growing season in higher areas than in lower areas. If the frost-free season alone is considered, however, an actual plant uses 10 to 12 inches of moisture, which is about one-half to one-third of the potential evapotranspiration if irrigated.

Water Supply

Water development in the Nevada County Area began with the many people who came during the Gold Rush (*17*). As gold mining declined at the turn

TABLE 10.—*Probabilities of last freezing temperatures in spring and first in fall* (*14*)

Temperature	Dates for given probability and temperature					
	Spring			Fall		
	1 year in 10 later than—	2 years in 10 later than—	5 years in 10 later than—	1 year in 10 earlier than—	2 years in 10 earlier than—	5 years in 10 earlier than—
Grass Valley, Nevada County, elevation 2693 feet.						
28° F. or lower	April 13	April 1	March 13	November 14	November 20	December 2
32° F. or lower	May 7	April 27	April 8	October 21	October 31	November 17
Auburn, Placer County, elevation 1297 feet.						
28° F. or lower	March 6	February 25	February 7	December 9	December 13	December 29
32° F. or lower	April 14	April 1	March 10	November 10	November 16	November 30

TABLE 11. *Temperature and precipitation data*

GRASS VALLEY, NEVADA COUNTY, ELEVATION 2,693 FEET (*14*)

Month	Temperature					Precipitation	
	Average daily—			Highest recorded	Lowest recorded	Average total	Average snow depth
	Maximum	Minimum	Mean				
	°F.	°F.	°F.	°F.	°F.	*Inches*	*Inches*
January	53.1	34.7	43.9	79	12	10.63	13.1
February	55.8	36.0	45.9	80	15	9.57	7.8
March	60.0	38.8	49.4	84	19	8.38	5.5
April	67.1	43.4	55.3	91	20	4.70	.7
May	74.7	49.1	61.9	96	29	2.48	.1
June	82.8	55.0	68.9	106	33	.60	0
July	92.2	62.6	77.4	106	35	.03	0
August	91.0	60.4	75.7	111	41	.02	0
September	86.0	56.4	71.2	105	34	.49	0
October	74.8	48.6	61.7	100	28	2.79	[1]
November	63.7	40.9	52.3	86	20	5.45	.2
December	52.6	40.2	46.4	79	16	9.61	2.8
Year	71.2	47.2	59.2	111	12	54.75	30.2
AUBURN, PLACER COUNTY, ELEVATION 1,297 FEET (*14*)							
January	54.0	35.6	44.8	74	17	7.07	.5
February	58.1	37.7	47.9	78	23	6.25	.2
March	62.5	40.2	51.4	85	26	5.38	.3
April	69.4	44.8	57.1	92	30	3.03	[1]
May	76.9	49.3	63.1	102	32	1.47	0
June	86.0	55.2	70.6	107	36	.38	0
July	94.6	60.9	77.8	110	41	[1]	0
August	93.7	58.7	76.2	110	41	.01	0
September	88.1	56.6	72.4	109	39	.31	0
October	77.3	49.5	63.4	98	30	1.73	0
November	65.3	42.1	53.7	88	26	3.53	0
December	54.3	37.5	46.9	76	19	5.94	[1]
Year	73.5	47.3	60.4	110	17	35.10	1.0

[1] Trace.

of the century, water was used increasingly for farming. Mining ditches were extended into the farmed parts of the foothills and used for irrigating orchards and pasture and for domestic water supply. The great amounts of time, labor, and money that were necessary to bring water from distant sources in mountain lakes and river bottoms for use on the high ridges are still evident from the miners' ditches which, even today, form a good part of the water distribution system in the area. These ditches stand as a monument to the activity of the gold mining era. Recent years, however, have seen a marked increase in modern development of water resources.

The Nevada Irrigation District supplies water to the cities of Grass Valley and Nevada City and their surrounding residential areas. Most homes in the outlying, farmed areas are supplied by Nevada Irrigation District ditches, which bring surface water from reservoirs at higher elevations. The amount of water available for farming irrigation and for domestic use is limited by the capacity of the ditches. Existing distribution facilities and costs determine where new agricultural development and domestic use are feasible.

Only a small amount of water is supplied from wells, and these wells usually provide only enough for domestic use. Essentially no well water in the Area is used for irrigation. The supply of water from springs, shallow wells, and small reservoirs is critical after a series of dry years.

History

The earliest attempt at settlement was made early in 1848 when John Rose, a trader, established an Indian trading post at Pleasant Valley (*17*). In January 1848 the discovery of gold at Coloma changed the course of events for Rose, as it did for all the early settlers in California. By the fall of that year, hundreds of prospectors were finding their way to the gravel bars and streambeds of the county. Scores of mining camps sprang up almost overnight. Soon a chain of camps dotted the Yuba River bars. Most of the pick-and-shovel placer mining endeavors were short lived, however, for the miners despaired when the diggings played out and moved to richer strikes elsewhere.

TABLE 12.—*Annual temperature extremes (14)*

Station	Average number of days in which—										
	Minimum temperature is less than—					Maximum temperature is more than—					
	16° F.	20° F.	24° F.	28° F.	32° F.	80° F.	85° F.	90° F.	95° F.	100° F.	105° F.	110° F.
Grass Valley, Nevada County, elevation 2,693 feet	0.46	2.4	6.2	15	39	129	97	64	29	9	1	0
Auburn, Placer County, elevation 1,297 feet	0	.61	1.6	6.8	25	140	108	77	45	16	3	0

TABLE 13.—*Probabilities of receiving less than indicated amounts of annual precipitation (4)*

Station	Probability				
	10 percent	33 percent	50 percent	67 percent	90 percent
	Inches	*Inches*	*Inches*	*Inches*	*Inches*
Grass Valley, Nevada County	37.4	47.5	53.5	59.9	73.0
Auburn, Placer County	23.5	30.2	34.2	38.7	48.0

Nevada County was organized from a part of Yuba County by an act of the State Legislature in May 1851. A year later, the county had a population that was exceeded only by the counties of San Francisco and Sacramento. Nevada City was first settled in the fall of 1849 and was made the county seat in 1851. The city had a phenomenal growth after gold was discovered nearby early in 1850. Deposits found there proved exceedingly rich. In 1850 a church was organized, and in 1854 the first public school was opened. Numerous mining camps were in the vicinity of the town, but none of them attained the dignity of becoming a town in its own right or developing into a trading center.

Grass Valley was the exception. The discovery of rich quartz deposits at Gold Hill in 1850 transformed the settlement, then known as Centerville, from a sawmill hamlet of 15 to 20 buildings into a town of more than 150 buildings. A school was erected in 1852, and a volunteer fire department was established the next year. In March 1855 Grass Valley was incorporated. Scores of mines had sensational production figures of nearly 120 million dollars by the close of the century, making Grass Valley one of the richest mining districts the world has ever known. Much feverish mining was carried on during the 1850's before an exodus to the Comstock Lode in Nevada reduced it. The eastern part of the Area began to take on added life early in the 1860's with the building of the Central Pacific Railroad. The western part, however, was without rail transportation until 1876, when the Nevada County Narrow Gauge Railroad was laid from Nevada City and Grass Valley to Colfax.

As the small mines began playing out and mining became big business because of the great capital required, many disappointed miners turned to timber and farming. In the 1890's the Area, as well as other farming areas of California, experienced an orchard-planting boom. Apples and pears became the golden crop. An estimated 20,000 acres were converted to orchards, and the importance of water for the prosperity of farming became very apparent. In January 1921 an election was held establishing the Nevada Irrigation District to provide water for the western part of Nevada County and part of Placer County.

Economic conditions after World War I were not favorable in the rural areas of the nation. By 1920 Nevada County's population dropped to about 10,000. On January 31, 1934, the price of gold was increased from $20.67 to $35.00 per fine ounce. Production rose and reached an alltime high in 1939 and 1941. In the Area, as well as in other motherlode regions, the population doubled by 1940 as people turned once more to the goldfields, because of the depression of the 1930's and widespread unemployment.

Agriculture also became more profitable. Cattle were raised in the western part of the Area, and irrigated commercial pear orchards were developed in the vicinity of Chicago Park. The Southern Pacific's transcontinental rail facilities were developed at Colfax. After World War II a number of sawmills were established to supply lumber for the Nation's postwar housing boom. Then some mills closed as timber production became stabilized on a sustained yield and marketing conditions became less favorable. About the same time, a disease called "pear decline" struck the Area's pear orchards and production diminished sharply.

A land boom began about 1957 largely because the Area was popular for retirement living and recrea-

tional activities. Lands formerly held and managed for their timber, mining, or farming value were promoted as real estate. Currently, suburban development is causing a significant population growth.

Population

In 1960 Nevada County had about 21,000 people, the same population that it had during the gold rush more than a century ago (*17*). In some intervening years the population dropped considerably, and a low point was reached in 1930, when it dropped to about one-half the 1952 and 1960 figure, or to about 10,000. The years 1950 to 1960 saw a net increase in population of slightly more than 1,000 or 5 percent, compared with a 48.5 percent increase for the State. It is estimated that 623 or 61 percent of this was the result of a natural increase and the remaining 400 of the net migration. By contrast, the State in the same period had an estimated natural increase of 39 percent and an estimated net migration of 61 percent.

The population increase from 1950 to 1960 took place in unincorporated areas. The two incorporated cities, Grass Valley and Nevada City, lost 560 persons despite the arrival of 450 new residents in 1960. About 90 percent of the county's population in 1960 lived in the Nevada City and Grass Valley census divisions, 65 percent in the Grass Valley division alone. In July 1965 it was estimated that 25,100 persons lived here, an increase of 4,200 or about 20 percent since April 1960.

The Area is favorable as a location for retirement living. Because of this the percentage of elderly persons in the population is unusually high. In 1960, the median age was 38 years, eight years higher than the State average. One third of the residents were at least 50 years of age in 1960. The average number of persons per household in 1960 was 2.79 for the county, compared with 3.05 for the State. The population is expected to increase relatively slowly unless jobs are created by industry that would attract people to the Area. The bulk of any population growth will take place in the western part of the Area, but some increase will take place around Truckee.

Industry

No significant representation of the manufacturing industry is in the Nevada County Area, except for a few small electronic and specialty manufacturing companies (*17*). The manufacturing industry is essentially nonexistent in the western part of the Area.

Until the 1940's lumber production was low. Then production began to climb and reached a high level in 1956, when the gold mines closed. Lumber then became the chief basic industry. Production generally has declined since 1956, but it seems to have stabilized at about 90 to 100 million board-feet per year. Of the 542,000 acres of forest land in Nevada County, about half is commercial timber. The western slopes of the Sierra Nevada mountain range support fast-growing pines and firs, and about two-thirds of the commercial timberland is privately owned. The Southern Pacific Land Company has the largest private holdings, more than 60,000 acres, 22,000 of which are in commercial timber. Private industry is placing increased emphasis on management of its land for sustained yield of forest products. Timber sales from private lands are estimated at about $250,000 annually and make up about half of the total annual timber cut. Practically all the timber is accessible by road. It is hauled to the mills by trucks over private forest service, county, and State roads. Most of the lumber is shipped by truck from eight mills in the Area.

The United States Forest Service and the California Division of Forestry are large employers in the Area, the Forest Service especially in summer.

Minerals and Mining

In comparison to their former importance, minerals now play a minor role in the economy of the Area. It is unlikely that gold mining will become significant again without re-evaluation or federal support. Minerals other than gold which have been produced in the county are asbestos, barite, copper, zinc, manganese, chrome, tungsten, iron, lead, and pyrite. Greatest production of most of these took place during the two World Wars. Sand, gravel, and crushed stone are now produced in very large amounts, and production is expected to increase as construction needs of the local population increase.

Tourism and Recreation

Tourism and recreation are significant in the Nevada County Area. Much of the tourism is centered in and around Nevada City and Grass Valley and in the eastern part of the survey area. Recreational activities are mostly in the timbered areas or around lakes and reservoirs.

General esthetic enjoyment and sightseeing make up probably the greater part of such activity, followed by winter sports. Of next importance are fishing, camping, and hunting. Due largely to the Area's easy accessibility and pleasant climate, outdoor tourism and recreation have outstanding potential for development here.

Transportation

The Nevada County Area is mostly dependent upon highway transportation for movement of people and goods. Despite its general rural, mountainous setting, almost all of the Area is accessible by road. State highways provide primary access and county roads, forest service roads, and other local roads provide secondary access. The eastern part of the Area in addition to highway transportation, has service by transcontinental rail facilities. To the west, port facilities are available at Sacramento, Stockton, and San Francisco.

Interstate Route No. 80 is the main east-west transcontinental highway into Nevada and adjacent to Nevada County. It runs concurrently with U.S. Highway No. 40 in Nevada. Entrance to Nevada County from interstate Route No. 80 can be made at Auburn in Pla-

cer County and off Interstate 80, 27 miles east of Nevada City by State Highway 20. Interstate 80 is an all-weather highway. State Route No. 89 connects with Interstate Route No. 80 at Truckee. State Route No. 89 extends to the entrance of the north-western part of Lake Tahoe and connects with Sierra and Plumas Counties to the north. State Route No. 49 traverses the mother-lode country in a north-south direction and is known as the Golden Chain Highway. It connects with Interstate Route No. 80 at Auburn and is the chief link between Nevada County and Sierra County. In Grass Valley, State Route No. 49 connects with California Route No. 20, which extends from Colfax and in turn connects with Interstate Route No. 80 which extends through Nevada City. State Route No. 20 originates on the coast at Fort Bragg and terminates at Interstate Route No. 80, 27 miles east of Nevada City. Most of the county is connected by paved county roads. Some county roads, however, are only graded gravel. Some of the steep and deep river canyons are crossed at only a few places.

The Grass Valley-Nevada City area is serviced by several truck lines, all providing daily pick-up and delivery service. Inbound truck service from most lines is overnight from the San Francisco-Oakland Bay area and the Stockton, Sacramento, and Chico areas. Outbound service takes about the same time or slightly longer.

Use of rail facilities in Grass Valley requires truck hauling and reloading if freight railway service is needed at Colfax, Auburn, or Roseville. Truckee has daily transcontinental freight and passenger railway service. It is also served by several transcontinental truck carriers on through runs. Rail piggy-back service is available at Roseville.

The opening of the port of Sacramento in July 1963 made ocean transportation available within 58 miles of Grass Valley. This shortened the round-trip distance to the nearest port by 104 miles. The use of port facilities requires truck transportation from Grass Valley or truck or rail transportation from Truckee to the ports of Sacramento, Stockton, or San Francisco. The availability of port facilities at Sacramento can be important to the future of the Area because of freight-rate advantages for bulk shipment of lumber, timber, and other natural resources to overseas markets.

Grass Valley and Nevada City are served by commercial bus lines. These lines connect with eastern cities at Auburn or continue to Sacramento and the San Francisco area. The bus lines also provide express service for shipments of small packages.

Air transportation generally has minor significance in the Area, but air taxi or air charter service is available for rapid transportation to the Bay Area or to Reno.

Farming

About one-third of the acreage of Nevada County is used for farming (*16*). Most of these farms are not economic units, and the average size of a farm has decreased as lands were sold and divided. Most are classified as half- or part-time farming operations or as residential structures. The average value per acre of farmland and farm buildings has more than doubled since 1955.

The Area's intensive crop acreage is mostly orchard land located in the western part of the Area, especially near Nevada City, Grass Valley, and Chicago Park, and below an elevation of 3,000 feet. About 99 percent of the total crop acreage is pasture and range. Woodland pasture and range provide, in addition to grazing, Christmas trees, posts, and firewood. Orchard acreage has decreased in recent years because of pear decline, a disease which kills pear trees. It is unlikely that pears will regain their former importance in local farming in the foreseeable future. In places, orchards have been replanted to apples and peaches. Cherries also offer potential as varieties of disease-free stock are found.

Livestock production, primarily beef cattle and calves, has been the main source of farm income. In recent years, however, income from poultry and poultry products has been significant. Both livestock and poultry prices fluctuate with the local market.

Farm income is important to the economy of the Area and agriculture has played a significant role in development, but it is not now as significant as it could be. The potential for farming development could improve if a better supply and distribution of irrigation water becomes available. Also, from advancements in agricultural research it is known that late-maturing crops, particularly fresh-market peaches and plums, would be suited to soils in the Area. Some of the best soils, however, have been subdivided for residential use, and other suitable land sold at prices which make its present use for crops economically prohibitive. Thus, it is clear that the future importance of commercial farming to the Area's total economy depends largely on the development and usage of better income crops and improved marketing. Equally important are the stabilization of the value of lands best suited for farming and the holding of these lands from other uses.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, salt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water holding capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Dryfarming. Production of crops that require some tillage in a subhumid or semiarid region, without irrigation. Usually involves use of periods of fallow, during which time enough moisture accumulates in the soil to allow production of a cultivated crop.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Evapotranspiration. The combined loss of water from a given area, and during a specified period of time, by evaporation from the soil surface and by transpiration from plants.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one

growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Forb. Any herbaceous plant, neither a grass nor a sedge, that is grazed on western ridges.

Fragipan. A loamy, brittle, subsurface horizon that is very low in organic-matter content and clay but is rich in silt or very fine sand. The layer is seemingly cemented. When dry, it is hard or very hard and has a high bulk density in comparison with the horizon or horizons above it. When moist, the fragipan tends to rupture suddenly if pressure is applied, rather than to deform slowly. The layer is generally mottled, is slowly or very slowly permeable to water, and has few or many bleached fracture planes that form polygons. Fragipans are a few inches to several feet thick; they generally occur below the B horizon, 15 to 40 inches below the surface.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineralogical, and biological properties of the various horizons, and their thickness and arrangement in the soil profile.

Mottled. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction.

In words, the degrees of acidity or alkalinity are expressed thus:

	pH		pH
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeters); II (0.2 to 0.02 millimeter); III (0.2 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements found in soils in extremely small amounts, yet which are essential to plant growth. Some of the trace elements are zinc, cobalt, manganese, copper, and iron.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

To obtain a complete description of a mapping unit, it is necessary to read the description of the mapping unit and the description of the soil series to which it belongs. Other information in this soil survey is in tables as follows:

Approximate acreage and extent, table 1, page 7.
Estimated yields, table 2, page 48.

Engineering uses of the soils, table 4, page 64; table 5, page 68; and table 6, page 74.
Uses of soils in community development, table 7, page 82.

Map symbol	Mapping unit	Page	Capability unit		Vegetative group	Range site	Woodland suitability group	Wildlife suitability group
			Symbol	Page	Symbol	Name	Number	Number
AdB	Ahwahnee sandy loam, 2 to 9 percent slopes	8	IIIe-1 (18)	42	G	Granitic	--	6
AdC	Ahwahnee sandy loam, 9 to 15 percent slopes	8	IVe-1 (18)	43	G	Granitic	--	6
AdD	Ahwahnee sandy loam, 15 to 30 percent slopes	8	VIe-1 (18)	45	G	Granitic	--	6
AeD	Ahwahnee-Rock outcrop complex, 15 to 30 percent slopes	8	VIs-1 (18)	46	G	Granitic	--	6
AeE	Ahwahnee-Rock outcrop complex, 30 to 50 percent slopes	8	VIIs-1 (18)	46	J	Granitic (steep phase)	--	6
AfB	Aiken loam, 2 to 9 percent slopes	10	IIe-1 (22)	42	A	----------	1	1
AfC	Aiken loam, 9 to 15 percent slopes	10	IIIe-1 (22)	42	A	----------	1	1
AfD	Aiken loam, 15 to 30 percent slopes	10	IVe-1 (22)	44	A	----------	2	1
AfE	Aiken loam, 30 to 50 percent slopes	10	VIe-1 (22)	45	A	----------	2	1
AgD	Aiken cobbly loam, 2 to 30 percent slopes	10	IVe-1 (22)	44	A	----------	2	1
AgE	Aiken cobbly loam, 30 to 50 percent slopes	10	VIe-1 (22)	45	A	----------	2	1
Am	Alluvial land, loamy	10	IIIw-8 (18,22)	43	E	----------	--	3
Ao	Alluvial land, clayey	10	IIIw-5 (18,22)	43	E	----------	--	3
ArC	Argonaut gravelly loam, 2 to 15 percent slopes	12	IVe-3 (18)	44	D	Claypan	--	6
AsD	Argonaut-Rock outcrop, complex, 2 to 30 percent slopes	12	VIs-1 (18)	46	D	Claypan	--	6
AtC	Auberry sandy loam, 5 to 15 percent slopes	13	IVe-1 (18)	43	G	Granitic	--	6
AuD	Auberry-Rock outcrop complex, 15 to 30 percent slopes	13	VIs-1 (18)	46	G	Granitic	--	6
AuE	Auberry-Rock outcrop complex, 30 to 50 percent slopes	13	VIIs-1 (18)	46	J	Granitic	--	6
AvD	Auburn loam, 2 to 30 percent slopes	13	IVe-8 (18)	44	G	Shallow Loamy	--	6
AwC	Auburn-Argonaut complex, 2 to 15 percent slopes	13	IVe-8 (18)	44	--	----------	--	6
	Auburn part	--	-----	--	G	Shallow Loamy	--	--
	Argonaut part	--	-----	---	D	Claypan	--	--

Map symbol	Mapping unit	Page	Capability unit	Page	Vegetative group	Range site	Woodland suitability group	Wildlife suitability group
			Symbol		Symbol	Name	Number	Number
AxD	Auburn-Rock outcrop complex, 2 to 30 percent slopes	14	VIs-1 (18)	46	G	Shallow Loamy	--	6
AxE	Auburn-Rock outcrop complex, 30 to 50 percent slopes	14	VIIs-1 (18)	46	G	Shallow Loamy	--	6
BoC	Boomer loam, 5 to 15 percent slopes	15	IIIe-1 (22)	42	A	Loamy	2	1
BoD	Boomer loam, 15 to 30 percent slopes	15	IVe-1 (22)	44	A	Loamy	3	1
BrD	Boomer-Rock outcrop complex, 5 to 30 percent slopes	15	VIs-1 (22)	46	A	Loamy	3	1
BrE	Boomer-Rock outcrop complex, 30 to 50 percent slopes	15	VIs-1 (22)	46	A	Loamy (steep phase)	5	1
CdE2	Chaix sandy loam, 15 to 50 percent slopes, eroded	16	VIe-1 (22)	45	J	----------	6	2
ChC2	Chaix-Hotaw complex, 5 to 15 percent slopes, eroded	16	IVe-1 (22)	44	G	----------	5	2
ChD2	Chaix-Hotaw complex, 15 to 30 percent slopes, eroded	16	VIe-1 (22)	45	G	----------	6	2
ChE2	Chaix-Hotaw complex, 30 to 50 percent slopes, eroded	16	VIs-1 (22)	46	J	----------	7	2
CkF	Chaix-Rock outcrop complex, 30 to 75 percent slopes	17	VIIs-1 (22)	46	J	----------	7	2
ClC	Chaix very stony loam, thick solum variant, 5 to 15 percent slopes	17	IVs-7 (22)	45	G	----------	--	2
ClD	Chaix very stony loam, thick solum variant, 15 to 30 percent slopes	17	VIs-1 (22)	46	G	----------	--	2
ClE	Chaix very stony loam, thick solum variant, 30 to 50 percent slopes	17	VIs-1 (22)	46	G	----------	--	2
CmB	Cohasset loam, 2 to 9 percent slopes	18	IIe-1 (22)	42	A	----------	1	1
CmC	Cohasset loam, 9 to 15 percent slopes	19	IIIe-1 (22)	42	A	----------	1	1
CmD	Cohasset loam, 15 to 30 percent slopes	19	IVe-1 (22)	44	A	----------	2	1
CoD	Cohasset cobbly loam, 5 to 30 percent slopes	19	IVe-7 (22)	44	A	----------	2	1
CoE	Cohasset cobbly loam, 30 to 50 percent slopes	19	VIe-1 (22)	45	A	----------	2	1
CsE	Cohasset-McCarthy cobbly loams, 15 to 50 percent slopes	19	VIe-1 (22)	45	--	----------	--	--
	Cohasset part	--	------	--	A	----------	2	1
	McCarthy part	--	------	--	G	----------	5	2
CsF	Cohasset-McCarthy cobbly loams, 50 to 75 percent slopes	19	VIIe-1 (22)	46	J	----------	--	--
	Cohasset part	--	------	--	--	----------	3	1
	McCarthy part	--	------	--	--	----------	6	2
Ct	Cut and fill land	19	VIIIs-1 (18,22)	47	J	----------	--	4
DrE	Dubakella, shallow variant-Rock outcrop complex, 2 to 50 percent slopes	21	VIIs-1 (18)	46	J	Serpentine	--	4

Map symbol	Mapping unit	Page	Capability unit		Vegetative group	Range site	Woodland suitability group	Wildlife suitability group
			Symbol	Page	Symbol	Name	Number	Number
Gr	Granitic rock land	21	VIIIs-1 (18,22)	47	J		--	4
HnB	Hoda sandy loam, 5 to 9 percent slopes	22	IIe-1 (22)	42	A		1	1
HnC	Hoda sandy loam, 9 to 15 percent slopes	22	IIIe-1 (22)	42	A		2	1
HnE	Hoda sandy loam, 15 to 50 percent slopes	22	VIe-1 (22)	45	A		3	1
HoC2	Hoda cobbly sandy loam, 2 to 15 percent slopes, eroded	22	IVe-7 (22)	44	A		2	1
HpF	Hoda-Rock outcrop complex, 50 to 75 percent slopes	22	VIIs-1 (22)	46	J		6	1
HrC	Horseshoe gravelly loam, 9 to 15 percent slopes	23	IVe-1 (22)	44	A		1	1
HrD	Horseshoe gravelly loam, 15 to 30 percent slopes	23	IVe-1 (22)	44	A		2	1
ImE	Iron Mountain cobbly loam, 2 to 50 percent slopes	24	VIIe-1 (22)	46	J		7	2
JoC	Josephine loam, 9 to 15 percent slopes	25	IIIe-1 (22)	42	A		1	1
JoD	Josephine loam, 15 to 30 percent slopes	25	IVe-1 (22)	44	A		2	1
JoE	Josephine loam, 30 to 50 percent slopes	25	VIe-1 (22)	45	A		2	1
JpD	Josephine cobbly loam, 5 to 30 percent slopes	26	VIe-1 (22)	45	A		5	1
JrE2	Josephine-Mariposa complex, 15 to 50 percent slopes, eroded	26	VIe-1 (22)	45	--		--	--
	Josephine part	--	------	--	A		2	1
	Mariposa part	--	------	--	G		5	2
JrF2	Josephine-Mariposa complex, 50 to 75 percent slopes, eroded	26	VIIs-1 (22)	46	--		--	--
	Josephine part	--	------	--	A		3	1
	Mariposa part	--	------	--	G		6	2
JsE	Josephine-Rock outcrop complex, 15 to 50 percent slopes	26	VIs-1 (22)	46	A		5	1
MaD	Mariposa gravelly loam, 2 to 30 percent slopes	27	IVe-8 (22)	45	G		5	2
McF2	Mariposa-Maymen complex, 50 to 75 percent slopes, eroded	27	VIIs-1 (22)	46	J		--	2
	Mariposa part	--	------	--	--		6	--
	Maymen part	--	------	--	--		7	--
MkE	Mariposa-Rock outcrop complex, 2 to 50 percent slopes	27	VIs-1 (22)	46	G		6	2
MmE2	Maymen-Mariposa complex, 2 to 50 percent slopes, eroded	28	VIIe-1 (22)	46	--		--	2
	Maymen part	--	------	--	J		7	--
	Mariposa part	--	------	--	G		6	--
MnE	McCarthy sandy loam, 15 to 50 percent slopes	29	VIe-1 (22)	45	G		6	2
MoC	McCarthy cobbly loam, 5 to 15 percent slopes	29	VIe-1 (22)	45	G		4	2
MoE	McCarthy cobbly loam, 15 to 50 percent slopes	29	VIe-1 (22)	45	G		5	2

Map symbol	Mapping unit	Page	Capability unit		Vegetative group	Range site	Woodland suitability group	Wildlife suitability group
			Symbol	Page	Symbol	Name	Number	Number
MrC	Musick sandy loam, 5 to 15 percent slopes	30	IIIe-1 (22)	42	A	----------	2	1
MrE	Musick sandy loam, 15 to 50 percent slopes	30	VIe-1 (22)	45	A	----------	3	1
MsE	Musick-Rock outcrop complex, 5 to 50 percent slopes	30	VIs-1 (22)	46	G	----------	3	1
Pr	Placer diggings	30	VIIs-1 (18,22)	46	J	Placer Diggings	--	4
RkD	Rescue-Rock outcrop complex, 5 to 30 percent slopes	32	VIs-1 (18)	46	G	Loamy	--	6
Rn	Rock land	32	VIIIs-1 (18,22)	47	J	----------	--	4
RoE	Rock outcrop-Ahwahnee complex, 9 to 50 percent slopes	32	VIIs-1 (18)	46	J	Granitic	--	6
RpD	Rock outcrop-Auburn complex, 2 to 30 percent slopes	32	VIs-1 (18)	46	J	Shallow Loamy	--	6
RrE	Rock outcrop-Dubakella complex, 5 to 50 percent slopes	32	VIIs-1 (22)	46	J	Serpentine	--	4
ScE	Secca-Rock outcrop complex, 2 to 50 percent slopes	33	VIIs-1 (22)	46	D	----------	--	2
SdC	Shenandoah sandy loam, 2 to 15 percent slopes	34	IIIw-3 (18)	43	D	Granitic	--	6
SfB	Sierra sandy loam, 2 to 9 percent slopes	35	IIIe-1 (18)	42	A	Granitic	--	5
SfC	Sierra sandy loam, 9 to 15 percent slopes	35	IVe-1 (18)	43	A	Granitic	--	5
SfD	Sierra sandy loam, 15 to 30 percent slopes	35	VIe-1 (18)	45	A	Granitic	--	5
SkD	Sierra-Rock outcrop complex, 15 to 30 percent slopes	35	VIs-1 (18)	46	A	Granitic	--	5
SkE	Sierra-Rock outcrop complex, 30 to 50 percent slopes	35	VIIs-1 (18)	46	J	Granitic (steep phase)	--	5
SlB	Sites loam, 2 to 9 percent slopes	36	IIe-1 (22)	42	A	----------	1	1
SlC	Sites loam, 9 to 15 percent slopes	36	IIIe-1 (22)	42	A	----------	1	1
SlD	Sites loam, 15 to 30 percent slopes	37	IVe-1 (22)	44	A	----------	2	1
SmC	Sites very stony loam, 2 to 15 percent slopes	37	IVs-7 (22)	45	A	----------	1	1
SmE	Sites very stony loam, 15 to 50 percent slopes	37	VIs-1 (22)	46	A	----------	2	1
SoC	Sobrante loam, 2 to 15 percent slopes	37	IIIe-8 (18)	43	G	Loamy	--	6
SoD	Sobrante loam, 15 to 30 percent slopes	38	IVe-8 (18)	44	G	Loamy	--	6
SrD	Sobrante-Rock outcrop complex, 2 to 30 percent slopes	38	VIs-1 (18)	46	G	Loamy	--	6
SrE	Sobrante-Rock outcrop complex, 30 to 50 percent slopes	38	VIs-1 (18)	46	G	Loamy	--	4
Ta	Tailings	38	VIIIs-1 (18,22)	47	J	----------	--	4

Map symbol	Mapping unit	Page	Capability unit		Vegetative group	Range site	Woodland suitability group	Wildlife suitability group
			Symbol	Page	Symbol	Name	Number	Number
TrC	Trabuco loam, 5 to 15 percent slopes	39	IVe-3 (18)	44	A	Granitic	--	5
TuD	Trabuco-Rock outcrop complex, 15 to 30 percent slopes	39	VIs-1 (18)	46	A	Granitic	--	5
TuE	Trabuco-Rock outcrop complex, 30 to 50 percent slopes	39	VIIs-1 (18)	46	J	Granitic (steep phase)	--	5

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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
FOREST SERVICE

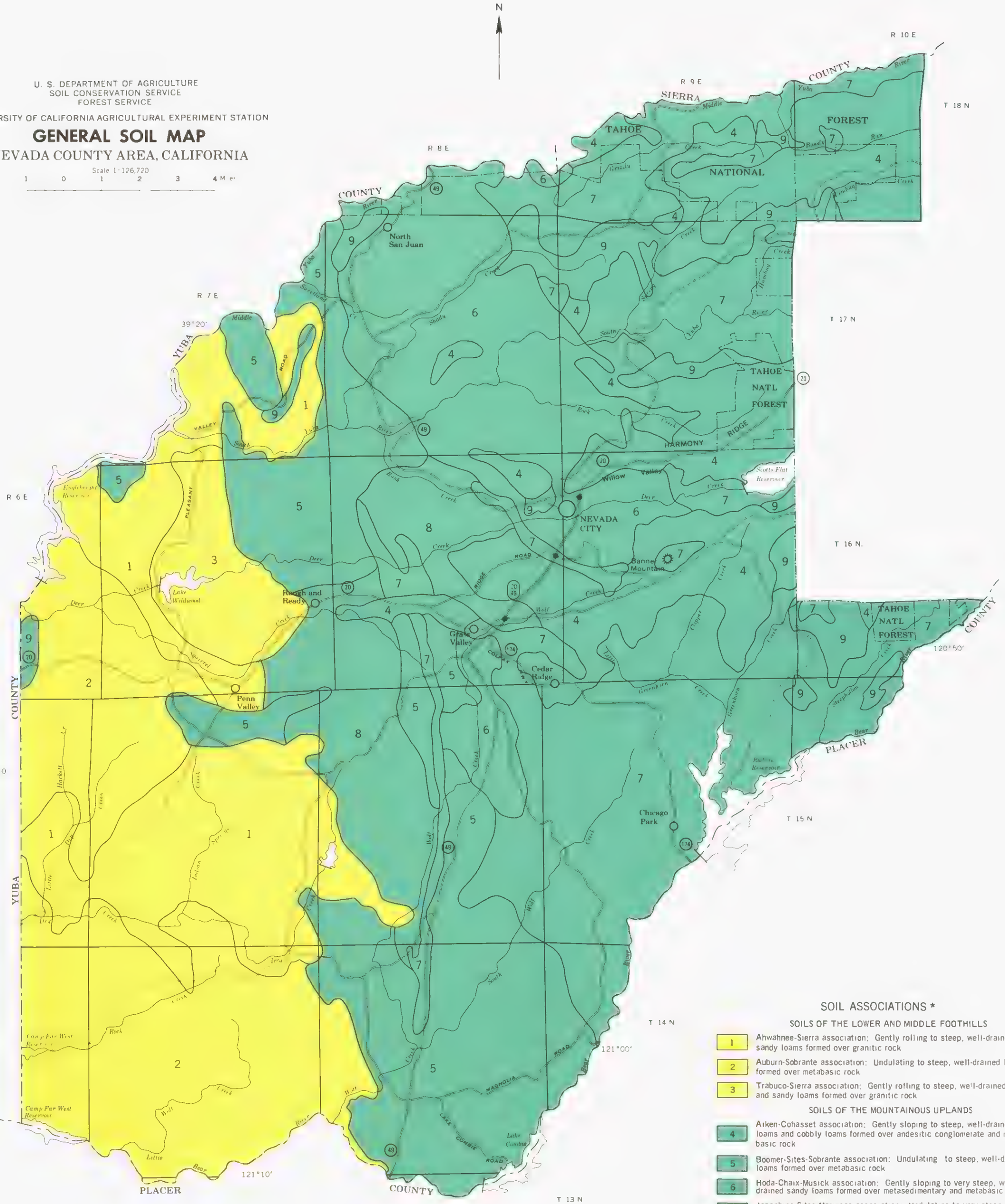
UNIVERSITY OF CALIFORNIA AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

NEVADA COUNTY AREA, CALIFORNIA

Scale 1:126,720

1 0 1 2 3 4 Miles



SOIL ASSOCIATIONS *

SOILS OF THE LOWER AND MIDDLE FOOTHILLS

1 Ahwahnee-Sierra association: Gently rolling to steep, well-drained sandy loams formed over granitic rock

2 Auburn-Sobrante association: Undulating to steep, well-drained loams formed over metabasic rock

3 Trabuco-Sierra association: Gently rolling to steep, well-drained loams and sandy loams formed over granitic rock

SOILS OF THE MOUNTAINOUS UPLANDS

4 Aiken-Cohasset association: Gently sloping to steep, well-drained loams and cobbly loams formed over andesitic conglomerate and metabasic rock

5 Boomer-Sites-Sobrante association: Undulating to steep, well-drained loams formed over metabasic rock

6 Hoda-Chaix-Musick association: Gently sloping to very steep, well-drained sandy loams formed over metasedimentary and metabasic rock

7 Josephine-Sites-Mariposa association: Undulating to very steep, well-drained loams formed over metasedimentary and metabasic rock

8 Secca-Boomer association: Undulating to steep, well-drained and moderately well drained gravelly silt loams and loams formed over metabasic rock

9 Placer diggings-Tailings-Horseshoe association. Placer mining debris, riverwash, waste rock, and rolling to hilly, well-drained loams formed over gravelly terrace remnants

* Texture refers to the surface layer of the major soils in each association

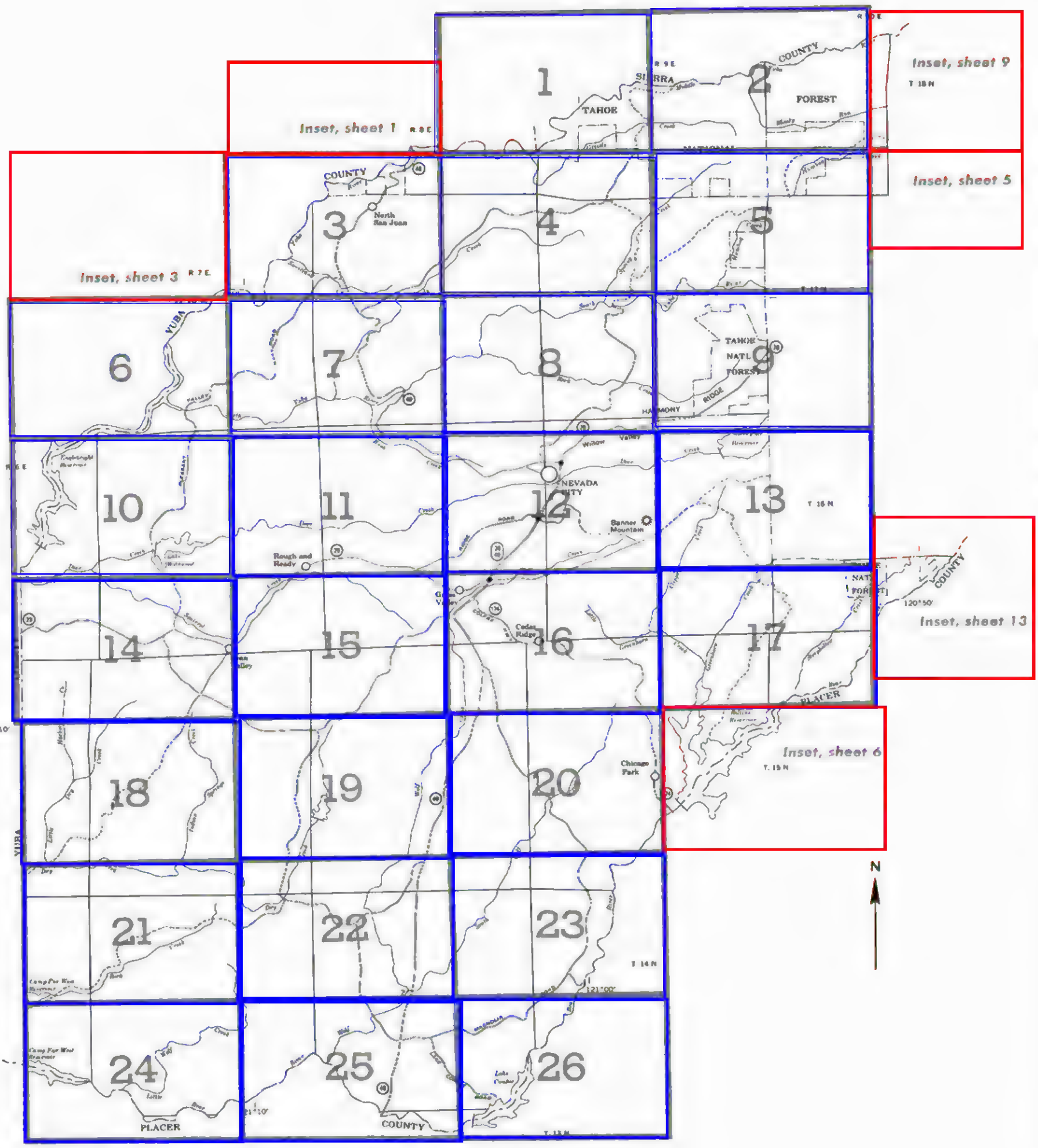
Compiled 1973

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts

INDEX TO MAP SHEETS
NEVADA COUNTY AREA, CALIFORNIA

Scale 1:190,080

1 0 1 2 3 4 Miles



SOIL LEGEND

The first capital letter is the initial one of the soil name. A second capital letter, B, C, D, E, or F, shows the slope. Most symbols without a slope letter are those of land types that have a considerable range of slope, but some are for nearly level soils. A final number, 2, in the symbol shows that the soil is eroded.

SYMBOL	NAME
AdB	Ahwahnee sandy loam, 2 to 9 percent slopes
AdC	Ahwahnee sandy loam, 9 to 15 percent slopes
AdD	Ahwahnee sandy loam, 15 to 30 percent slopes
AeD	Ahwahnee-Rock outcrop complex, 15 to 30 percent slopes
AeE	Ahwahnee-Rock outcrop complex, 30 to 50 percent slopes
AfB	Aiken loam, 2 to 9 percent slopes
AfC	Aiken loam, 9 to 15 percent slopes
AfD	Aiken loam, 15 to 30 percent slopes
AfE	Aiken loam, 30 to 50 percent slopes
AgD	Aiken cobbly loam, 2 to 30 percent slopes
AgE	Aiken cobbly loam, 30 to 50 percent slopes
Am	Alluvial land, loamy
Ao	Alluvial land, clayey
ArC	Argonaut gravelly loam, 2 to 15 percent slopes
AsD	Argonaut-Rock outcrop complex, 2 to 30 percent slopes
AtC	Auberry sandy loam, 5 to 15 percent slopes
AuD	Auberry-Rock outcrop complex, 15 to 30 percent slopes
AuE	Auberry-Rock outcrop complex, 30 to 50 percent slopes
AvD	Auburn loam, 2 to 30 percent slopes
AwC	Auburn-Argonaut complex, 2 to 15 percent slopes
AxD	Auburn-Rock outcrop complex, 2 to 30 percent slopes
AxE	Auburn-Rock outcrop complex, 30 to 50 percent slopes
BoC	Boomer loam, 5 to 15 percent slopes
BoD	Boomer loam, 15 to 30 percent slopes
BrD	Boomer-Rock outcrop complex, 5 to 30 percent slopes
BrE	Boomer-Rock outcrop complex, 30 to 50 percent slopes
CdE2	Chaix sandy loam, 15 to 50 percent slopes, eroded
ChC2	Chaix-Hotaw complex, 5 to 15 percent slopes, eroded
ChD2	Chaix-Hotaw complex, 15 to 30 percent slopes, eroded
ChE2	Chaix-Hotaw complex, 30 to 50 percent slopes, eroded
CkF	Chaix-Rock outcrop complex, 30 to 75 percent slopes
ClC	Chaix very stony loam, thick solum variant, 5 to 15 percent slopes
ClD	Chaix very stony loam, thick solum variant, 15 to 30 percent slopes
ClE	Chaix very stony loam, thick solum variant, 30 to 50 percent slopes
CmB	Cohasset loam, 2 to 9 percent slopes
CmC	Cohasset loam, 9 to 15 percent slopes
CmD	Cohasset loam, 15 to 30 percent slopes
CoD	Cohasset cobbly loam, 5 to 30 percent slopes
CoE	Cohasset cobbly loam, 30 to 50 percent slopes
CsE	Cohasset-McCarthy cobbly loams, 15 to 50 percent slopes
CsF	Cohasset-McCarthy cobbly loams, 50 to 75 percent slopes
Ct	Cut and fill land
DrE	Dubakella, shallow variant-Rock outcrop complex, 2 to 50 percent slopes
Gr	Granitic rock land
HnB	Hoda sandy loam, 5 to 9 percent slopes
HnC	Hoda sandy loam, 9 to 15 percent slopes
HnE	Hoda sandy loam, 15 to 50 percent slopes
HoC2	Hoda cobbly sandy loam, 2 to 15 percent slopes, eroded
HpF	Hoda-Rock outcrop complex, 50 to 75 percent slopes
HrC	Horseshoe gravelly loam, 9 to 15 percent slopes
HrD	Horseshoe gravelly loam, 15 to 30 percent slopes
ImE	Iron Mountain cobbly loam, 2 to 50 percent slopes
JoC	Josephine loam, 9 to 15 percent slopes
JoD	Josephine loam, 15 to 30 percent slopes
JoE	Josephine loam, 30 to 50 percent slopes
JpD	Josephine cobbly loam, 5 to 30 percent slopes
JrE2	Josephine-Mariposa complex, 15 to 50 percent slopes, eroded
JrF2	Josephine-Mariposa complex, 50 to 75 percent slopes, eroded
JsE	Josephine-Rock outcrop complex, 15 to 50 percent slopes
MaD	Mariposa gravelly loam, 2 to 30 percent slopes
McF2	Mariposa-Maymen complex, 50 to 75 percent slopes, eroded
MkE	Mariposa-Rock outcrop complex, 2 to 50 percent slopes
MmE2	Maymen-Mariposa complex, 2 to 50 percent slopes, eroded
MnE	McCarthy sandy loam, 15 to 50 percent slopes
MoC	McCarthy cobbly loam, 5 to 15 percent slopes
MoE	McCarthy cobbly loam, 15 to 50 percent slopes
MrC	Musick sandy loam, 5 to 15 percent slopes
MrE	Musick sandy loam, 15 to 50 percent slopes
MsE	Musick-Rock outcrop complex, 5 to 50 percent slopes
Pr	Placer diggings
RkD	Rescue-Rock outcrop complex, 5 to 30 percent slopes
Rn	Rock land
RoE	Rock outcrop-Ahwahnee complex, 9 to 50 percent slopes
RpD	Rock outcrop-Auburn complex, 2 to 30 percent slopes
RrE	Rock outcrop-Dubakella complex, 5 to 50 percent slopes
ScE	Secca-Rock outcrop complex, 2 to 50 percent slopes
SdC	Shenandoah sandy loam, 2 to 15 percent slopes
SfB	Sierra sandy loam, 2 to 9 percent slopes
SfC	Sierra sandy loam, 9 to 15 percent slopes
SfD	Sierra sandy loam, 15 to 30 percent slopes
SkD	Sierra-Rock outcrop complex, 15 to 30 percent slopes
SkE	Sierra-Rock outcrop complex, 30 to 50 percent slopes
SlB	Sites loam, 2 to 9 percent slopes
SlC	Sites loam, 9 to 15 percent slopes
SlD	Sites loam, 15 to 30 percent slopes
SmC	Sites very stony loam, 2 to 15 percent slopes
SmE	Sites very stony loam, 15 to 50 percent slopes
SoC	Sobrante loam, 2 to 15 percent slopes
SoD	Sobrante loam, 15 to 30 percent slopes
SrD	Sobrante-Rock outcrop complex, 2 to 30 percent slopes
SrE	Sobrante-Rock outcrop complex, 30 to 50 percent slopes
To	Tailings
TrC	Trabuco loam, 5 to 15 percent slopes
TuD	Trabuco-Rock outcrop complex, 15 to 30 percent slopes
TuE	Trabuco-Rock outcrop complex, 30 to 50 percent slopes

NEVADA COUNTY AREA, CALIFORNIA

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads

Divided

Good motor

Poor motor

Trail

Highway markers

National interstate

U. S.

State or county

Railroads

Single track

Multiple track

Abandoned

Bridges and crossings

Road

Trail

Railroad

Ferry — FY

Ford — FORD

Grade

R. R. over

R. R. under

Buildings

School

Church

Mine and quarry

Gravel pit — G.P.

Power line

Pipe line

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

National or state

County

Minor civil division

Reservation

Soil survey

Small park, cemetery, airport

Land survey division corners

DRAINAGE

Streams, double line

Perennial

Intermittent

Streams, single line

Perennial

Intermittent

Crossable with tillage implements

Not crossable with tillage implements

Unclassified

Canal or ditch, single line

Irrigation

Lakes and ponds

Perennial — water — w

Intermittent — int

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments

Bedrock

Other

Short steep slope

Prominent peak

Depressions

	Large	Small
Crossable with tillage implements		
Not crossable with tillage implements		
Contains water most of the time		

SOIL SURVEY DATA

Soil boundary and symbol — Dx

Gravel

Stoniness: Stony; Very stony

Rock outcrops

Chert fragments

Clay spot

Sand spot

Gumbo or scabby spot

Made land

Severely eroded spot

Blowout and wind erosion

Gully

Soil sample site — S

NEVADA SOIL SURVEY AREA

SOIL TYPE LOCATION

SERIES	ATLAS SHEET	PART OF ATLAS SHEET
Ahwannee	22	NW
Aiken	12	SE
Argonaut	14	NW
Auberry	22	NW
Auburn	21	NW
Boomer	14	SE
Chaix	1	NE
Chaix, thick solum variant	11	NE
Cohasset	8	SE
Dubakella	11	NE
Dubakella, shallow variant	22	NE
Hoda	8	Near center of sheet
Horseshoe	4	SE near center of sheet
Hotaw	7	NE
Iron Mountain	2	SE
Josephine	1	SE
Mariposa	1	SE
Maymen	2	SE
McCarthy	2	SE
Musick	4	NW
Rescue	26	NW
Secca	19	NE
Shenandoah	22	NW
Sierra	22	NW
Sites	4	SE
Sobrante	25	NW
Trabuco	10	NE

NEVADA COUNTY AREA, CALIFORNIA NO. 1

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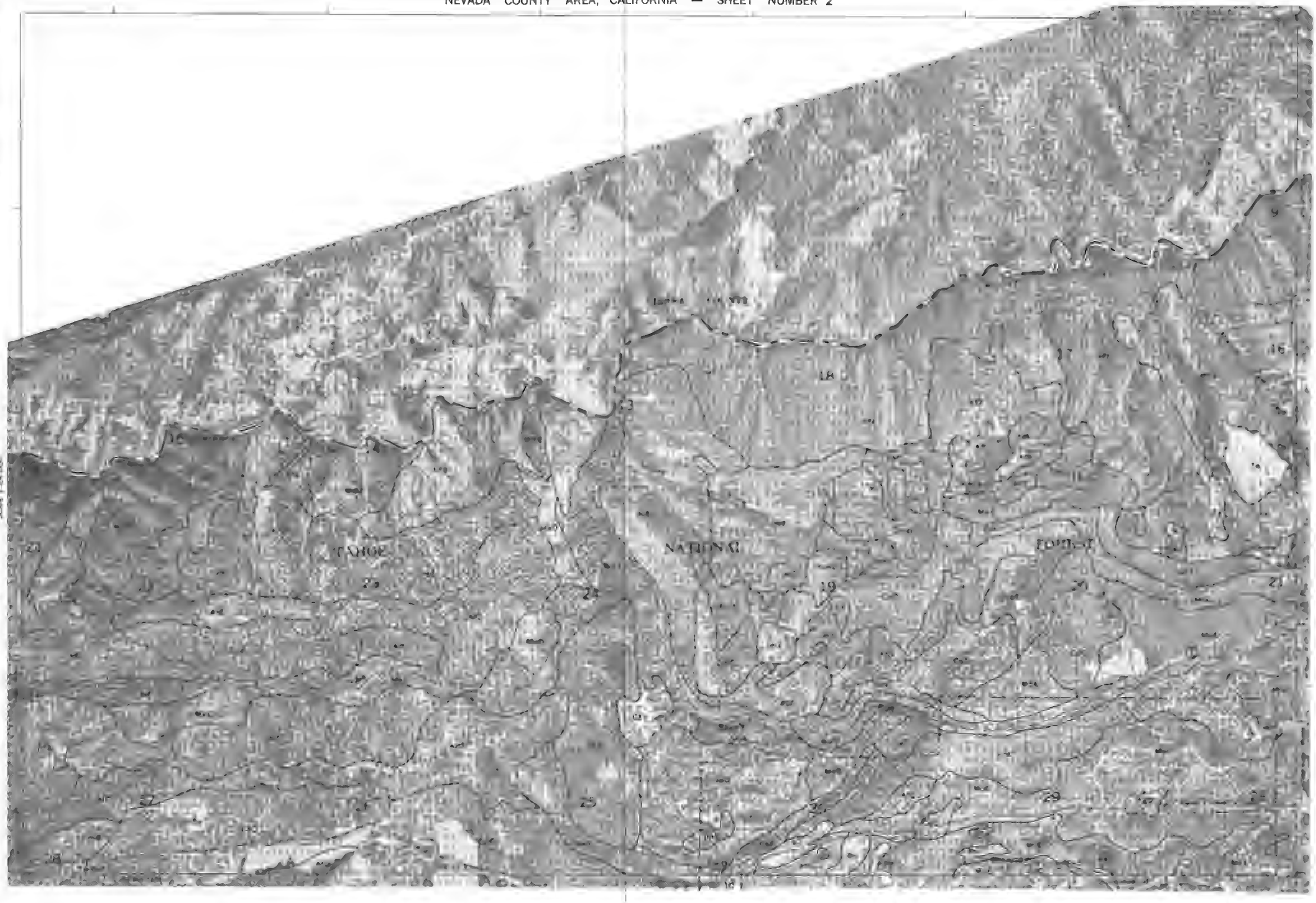
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum.
Land division corners are approximately positioned on this map

2 265 000 FEET
645 000 FEET
R. 8 E.
T. 18 N.
YUBA COUNTY
MIDDLE YUBA RIVER
TAHOE NATL FOR
(Joins sheet 3)
2 260 000 FEET
(Joins sheet 4)
YUBA COUNTY
Emory Island
MIDDLE YUBA RIVER
TNF
YUBA COUNTY
SIERRA COUNTY
R. 8 E.
R. 9 E.
TAHOE NATIONAL FOREST
Grizzly Creek
(Joins sheet 2)
2 290 000 FEET
McF2
JrF2
JrE2
JoC
JoD
SID
HnE
CkF
JoE
SmE
JsE
CgE
AfD
CmB
16
20
21
28
29
30
25
26
27

1 2 Miles 10 000 Feet
1 5 000 0
Scale 1:24 000
0 1000 2000 3000 4000 5000

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 2



Land division corners are approximately positioned on this map

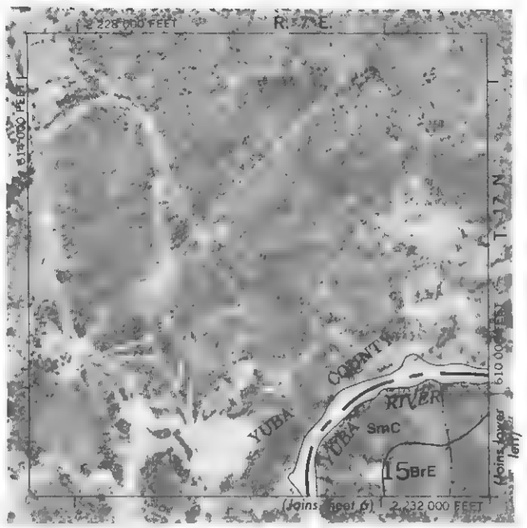
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.

Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum.

NEVADA COUNTY AREA, CALIFORNIA NO. 2

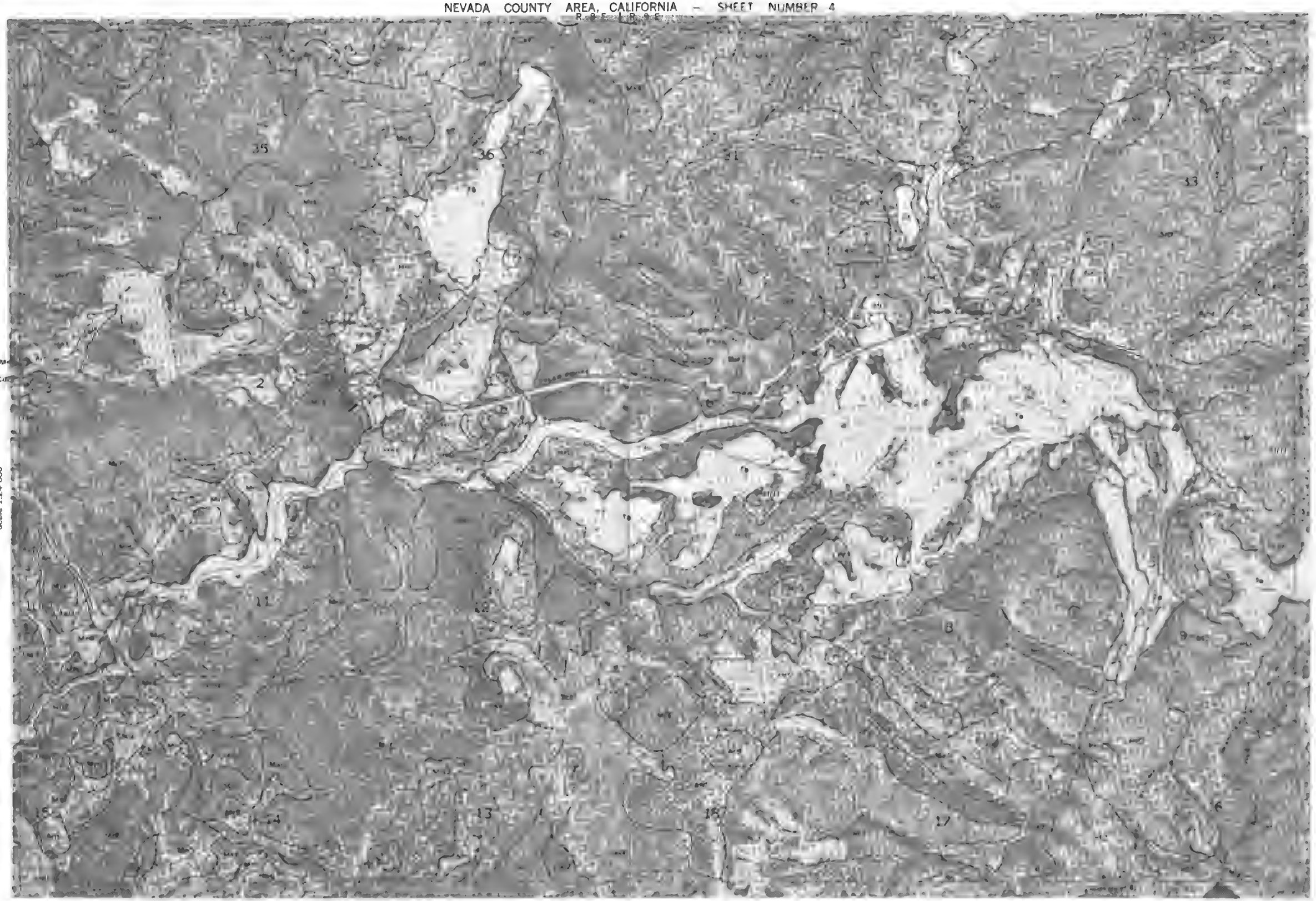
NEVADA COUNTY AREA, CALIFORNIA NO. 3

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum
Land division corners are approximately positioned on this map.



4 000 FOOT GRID TICKS

NEVADA COUNTY AREA, CALIFORNIA – SHEET NUMBER 4



4 2 0 2 Miles

10 000 feet 5000 0

Scale 1:24 000

5 000 4000 3000 2000 1000 0

Land division corners are approximately positioned on this map

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of Ca[illegible] Pe[illegible]ural Experiment Station

Photobase from 1972 aerial photography Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum.

NEVADA COUNTY AREA, CALIFORNIA NO. 4

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 5

NEVADA COUNTY AREA, CALIFORNIA NO. 5

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum
Land division corners are approximately positioned on this map.

(Joins sheet 2)

(Joins sheet 9)

(Joins inset, sheet 6)

(Joins upper right)

(Joins inset)

TAHOE NATIONAL FOREST

Buck Mountain

Marshoff Diggings

Kenebec Creek

Humbug Creek

Spring Creek

NORTH BLOOMFIELD ROAD

GRANITE HILL ROAD

SOUTH YUBA RIVER

LIMIT OF SOIL SURVEY

TAHOE NATL FOREST

2 000 AND 5 000 FOOT GRID TICKS

2 320 000 FEET

6 610 000 FEET

Scale 1:24 000

2 Miles

10 000 Feet

5000

1

N

2 Miles

10 000 Feet

Scale 1:24 000

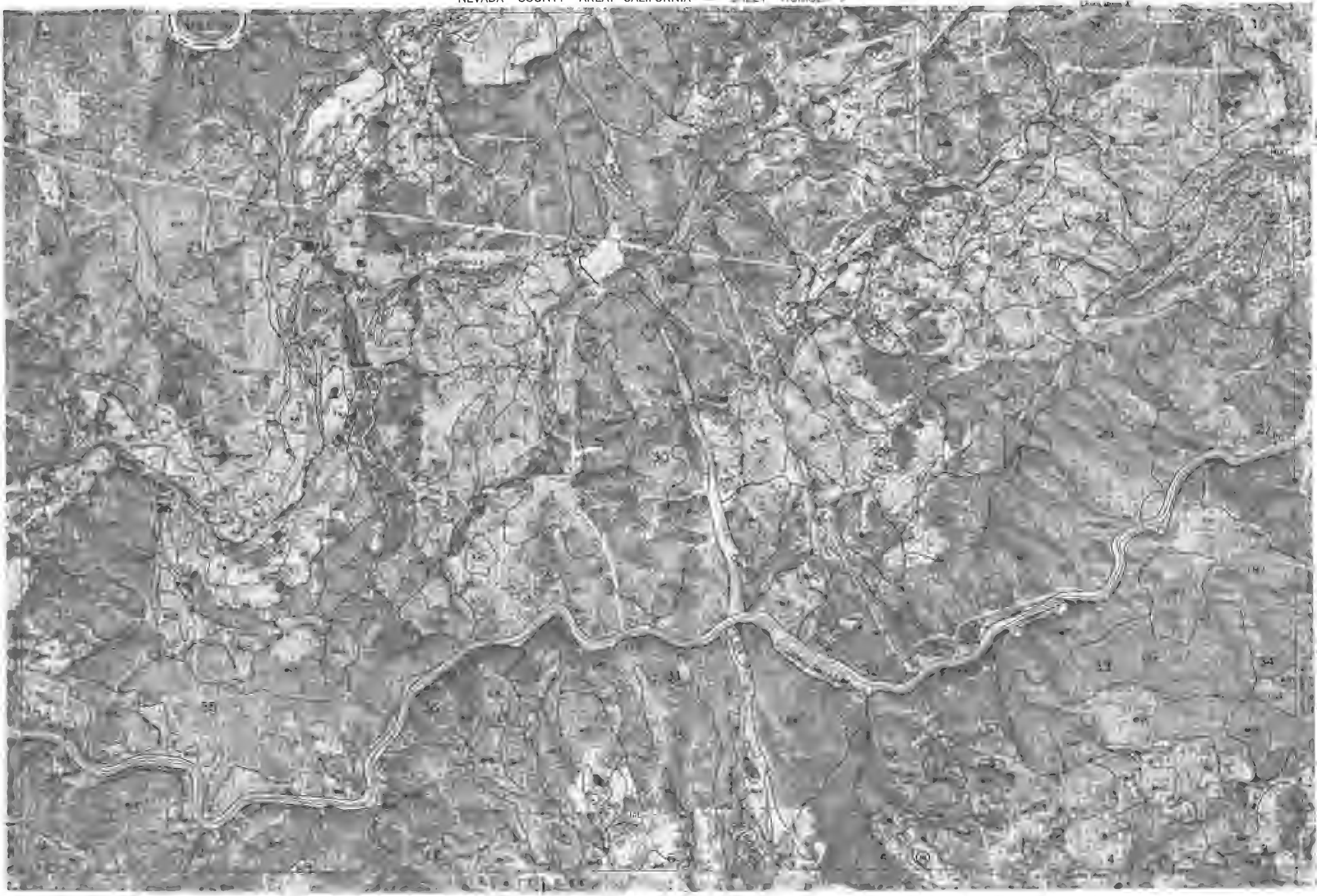
ROLLINS RESERVOIR

R 9 E | R 10 E

NEVADA COUNTY AREA, CALIFORNIA NO. 6

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 7



N

10 000 Feet

5000

0

1000

5000

Scale 1:24 000

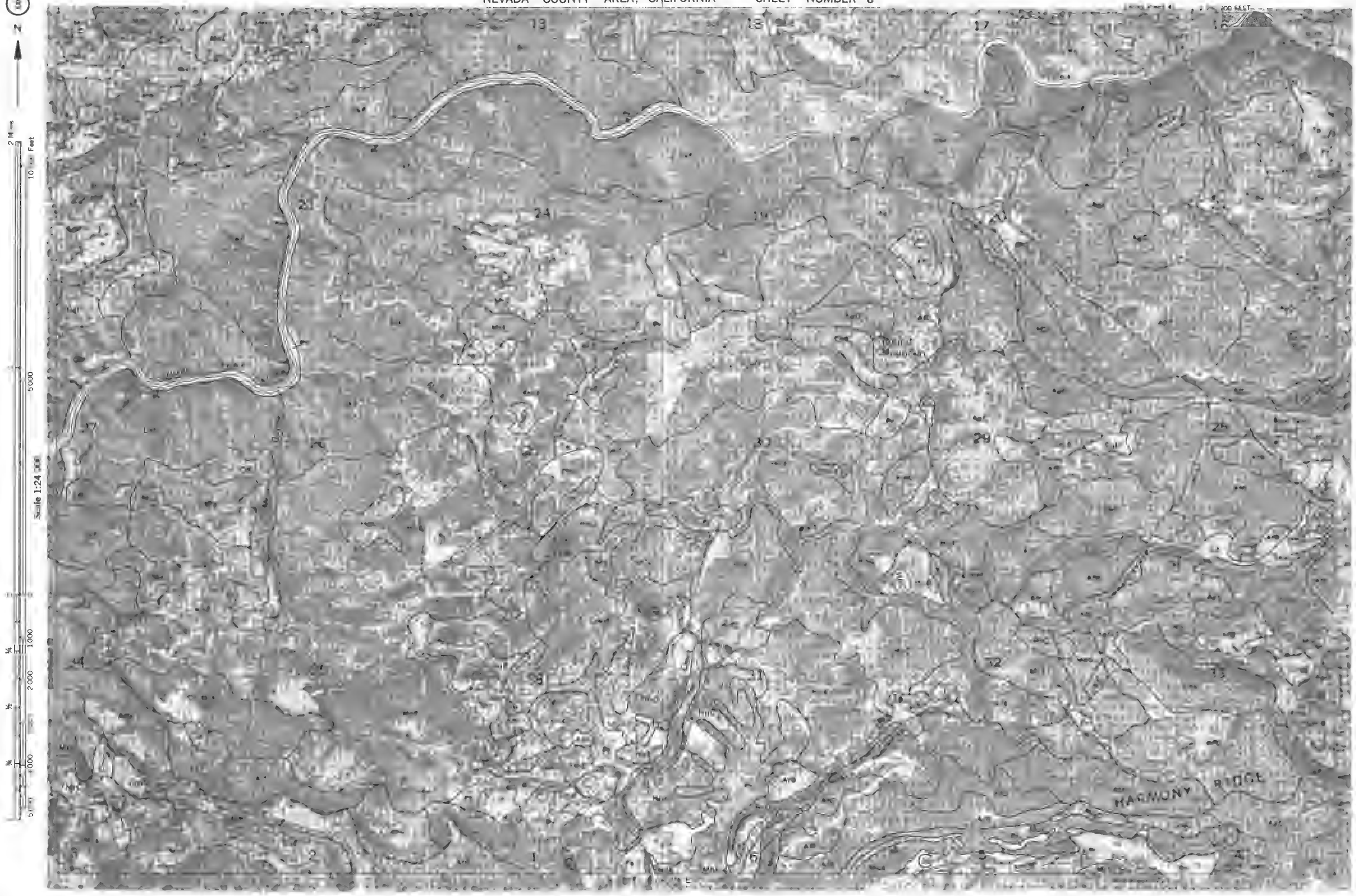
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum.

Land division corners are approximately positioned on this map

NEVADA COUNTY AREA, CALIFORNIA NO. 7

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 8



Land division corners are approximately positioned on this map

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U S. Forest Service and the University of California Agricultural Experiment Station.

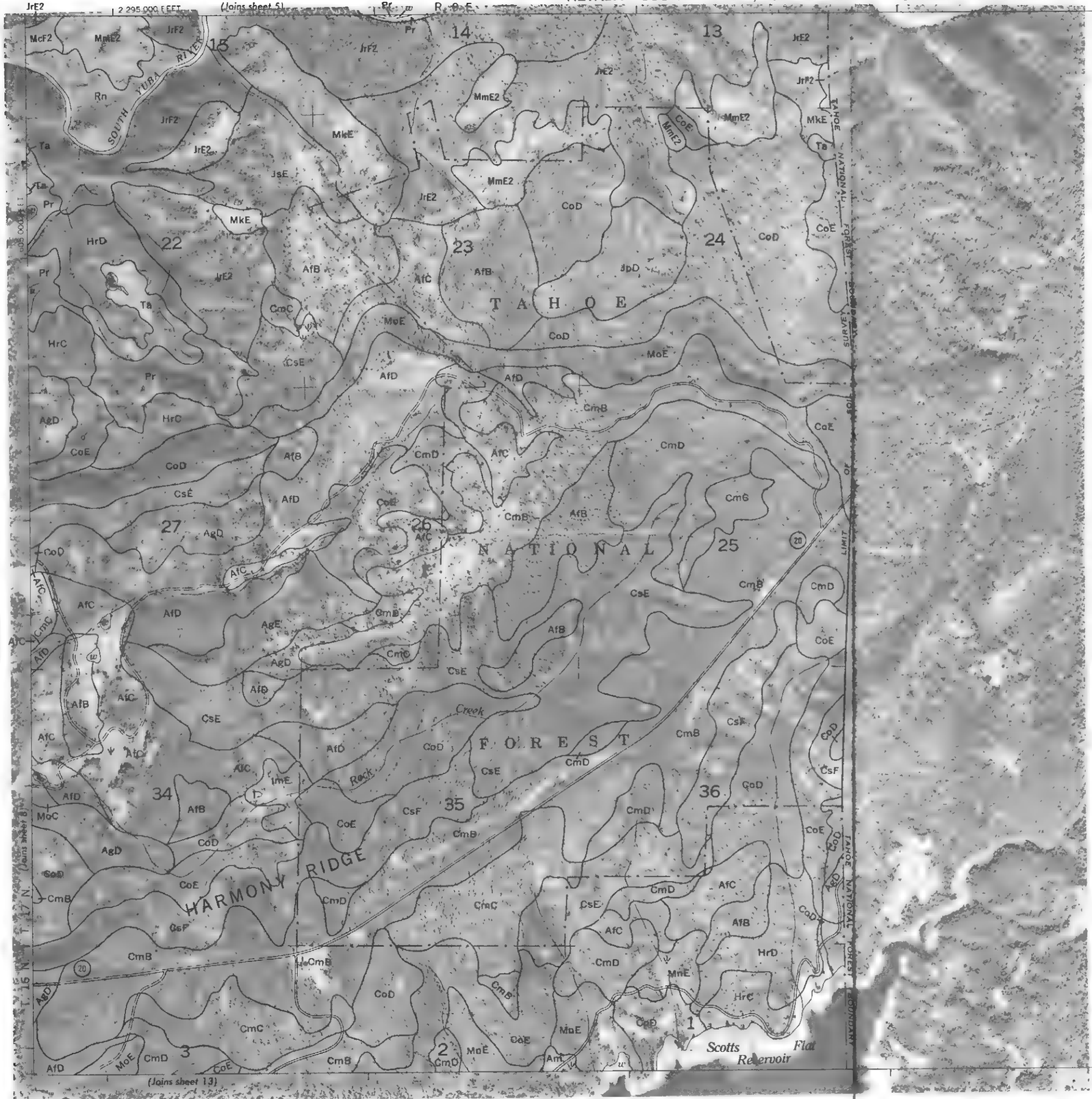
Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum

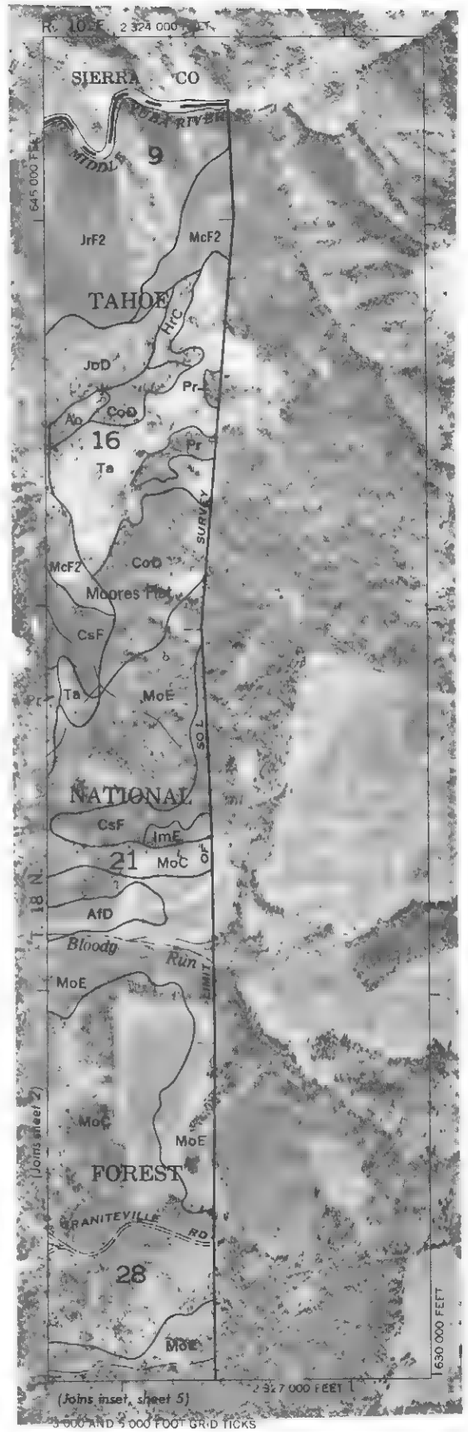
NEVADA COUNTY AREA, CALIFORNIA NO. 8

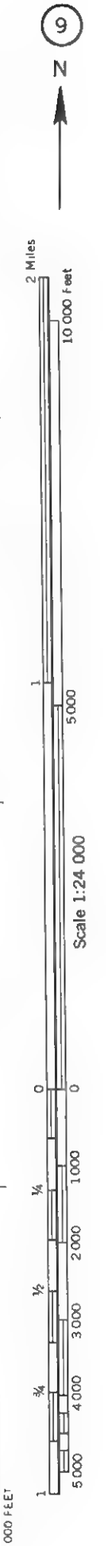
NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 9

NEVADA COUNTY AREA, CALIFORNIA NO. 9

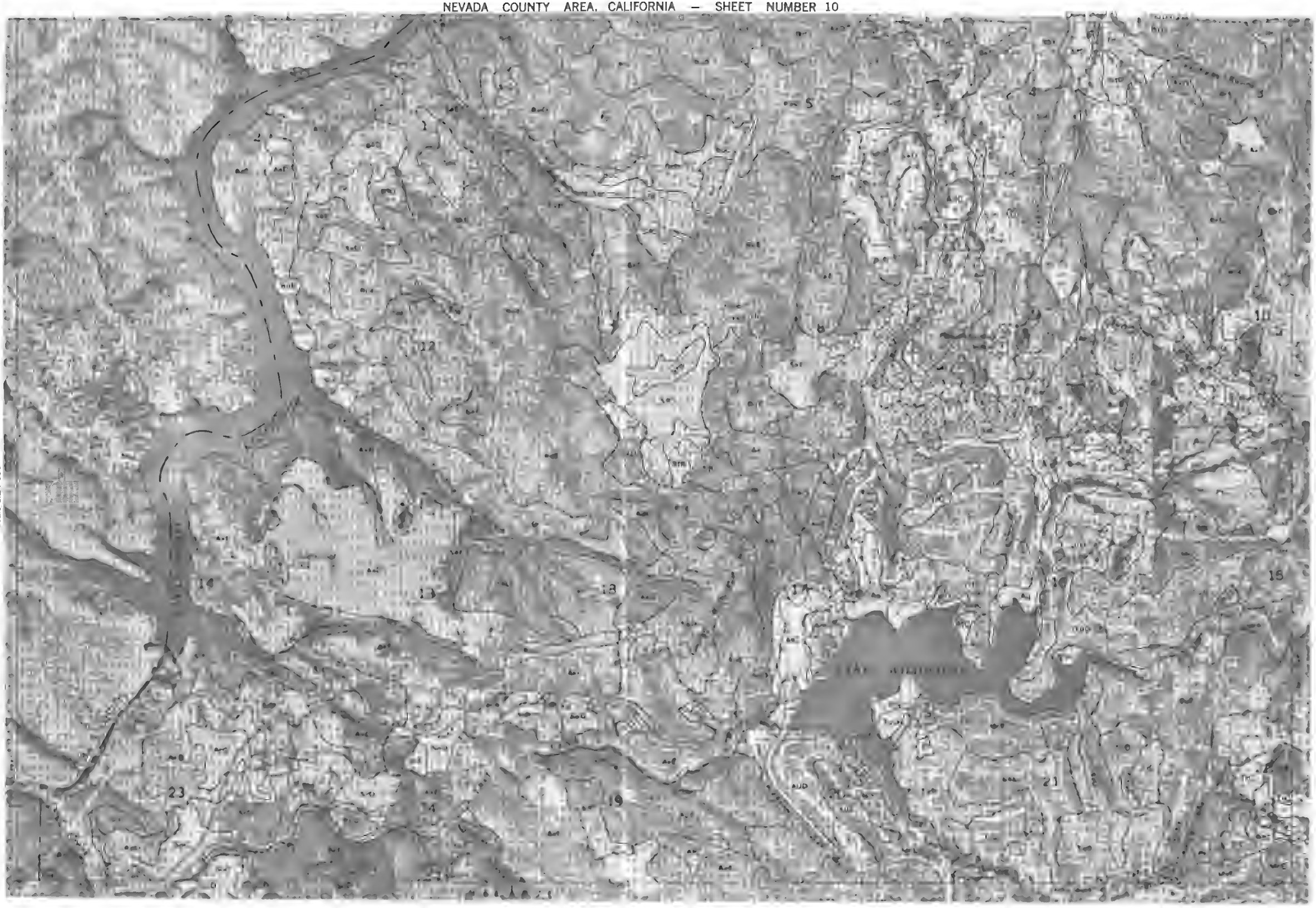
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum
Land divisions on corners are approximately positioned on this map







NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 10



Land division corners are approximately positioned on this map

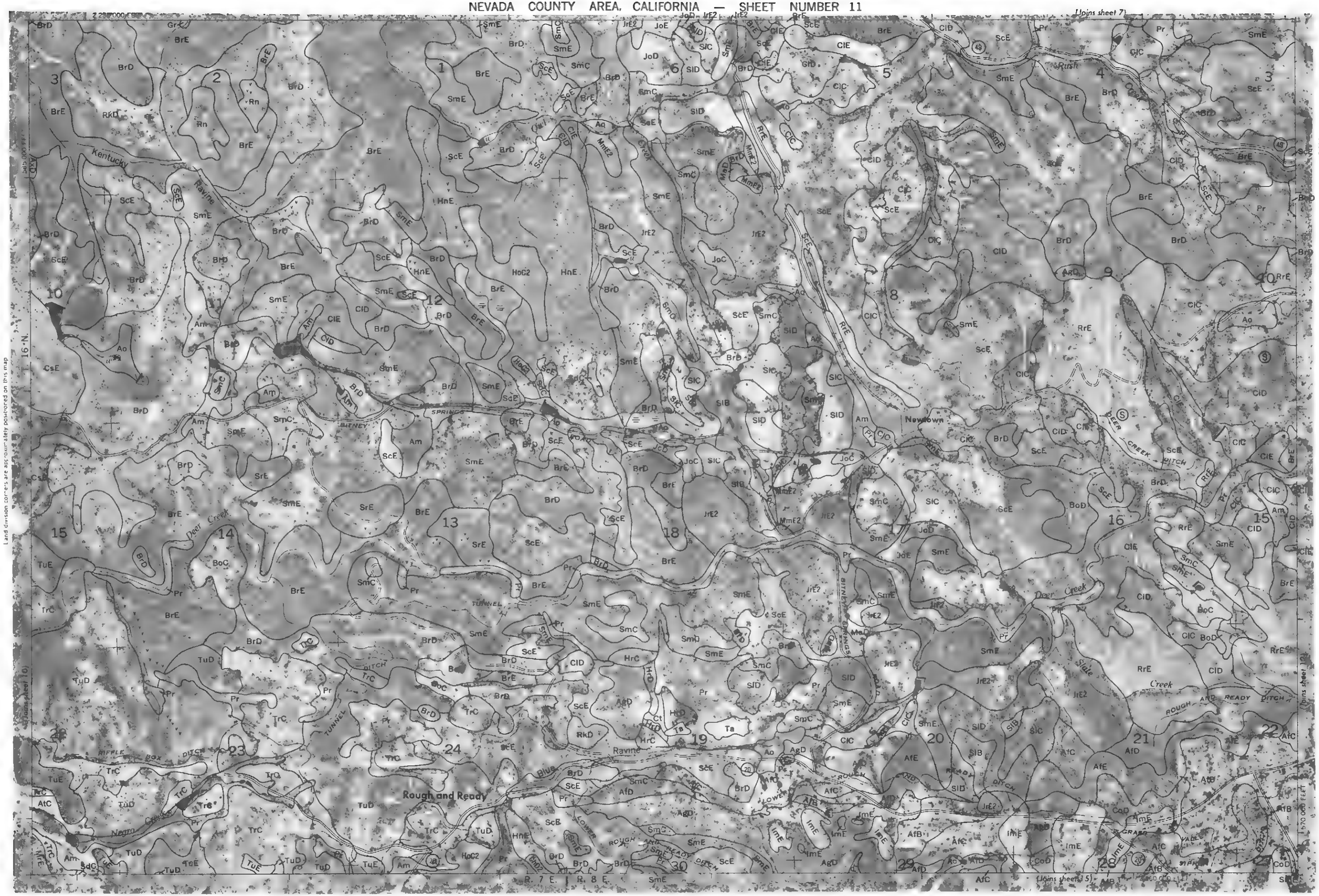
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station

Photobase from 1972 aerial photography Positions of 5,000 foot grid tick are approximate and based on the California coordinate system, zone 2, 1927 North American datum

NEVADA COUNTY AREA, CALIFORNIA NO. 10

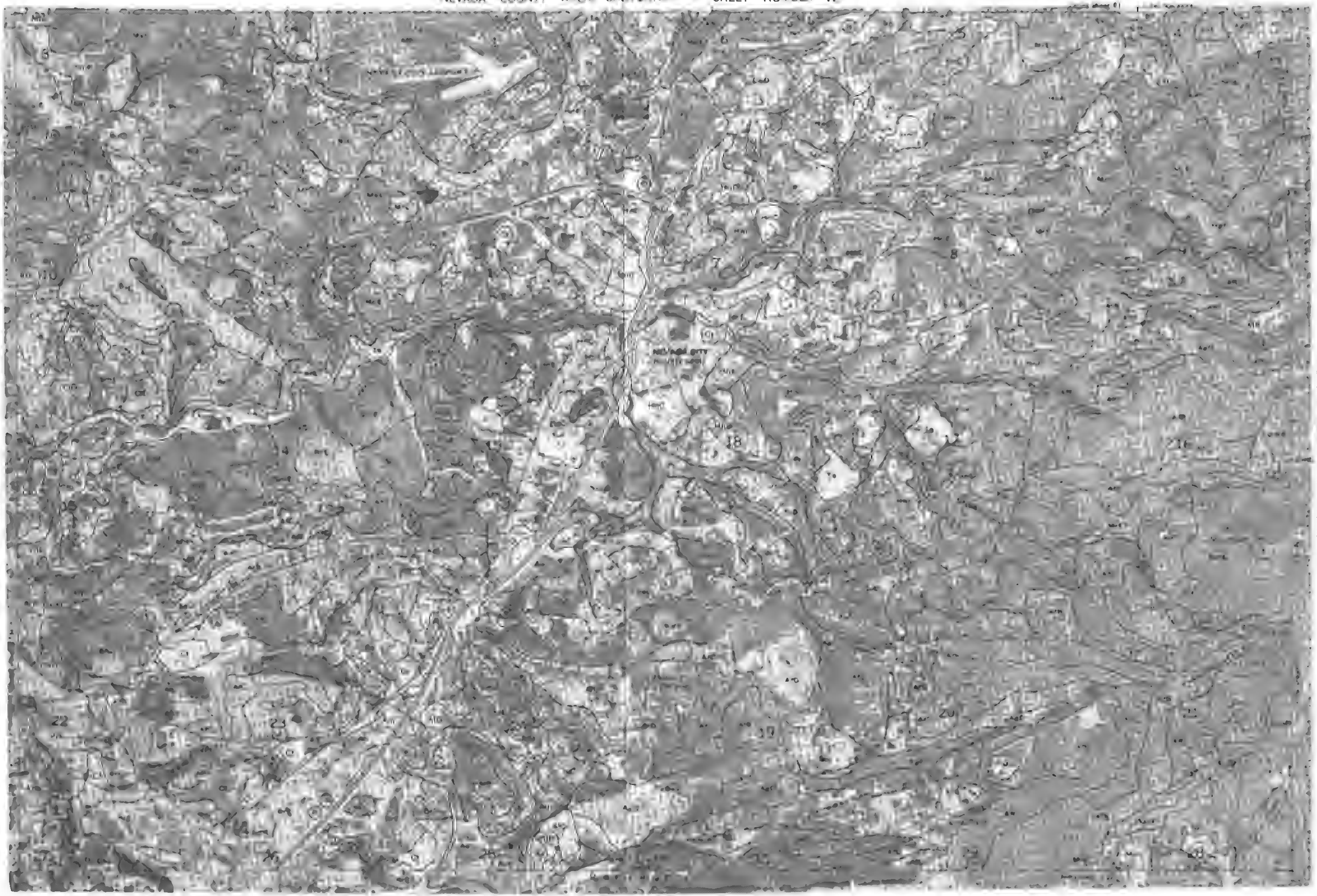
NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 11

NEVADA COUNTY AREA, CALIFORNIA NO. 11



This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum
Land division corners are approximately positioned on this map

NEVADA COUNTY AREA CALIFORNIA — SHEET NUMBER 12



Scale 1:24 000

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2. 1927 North American datum

Land divisions on corners are approx ___ positioned on this map

NEVADA COUNTY AREA, CALIFORNIA NO 12

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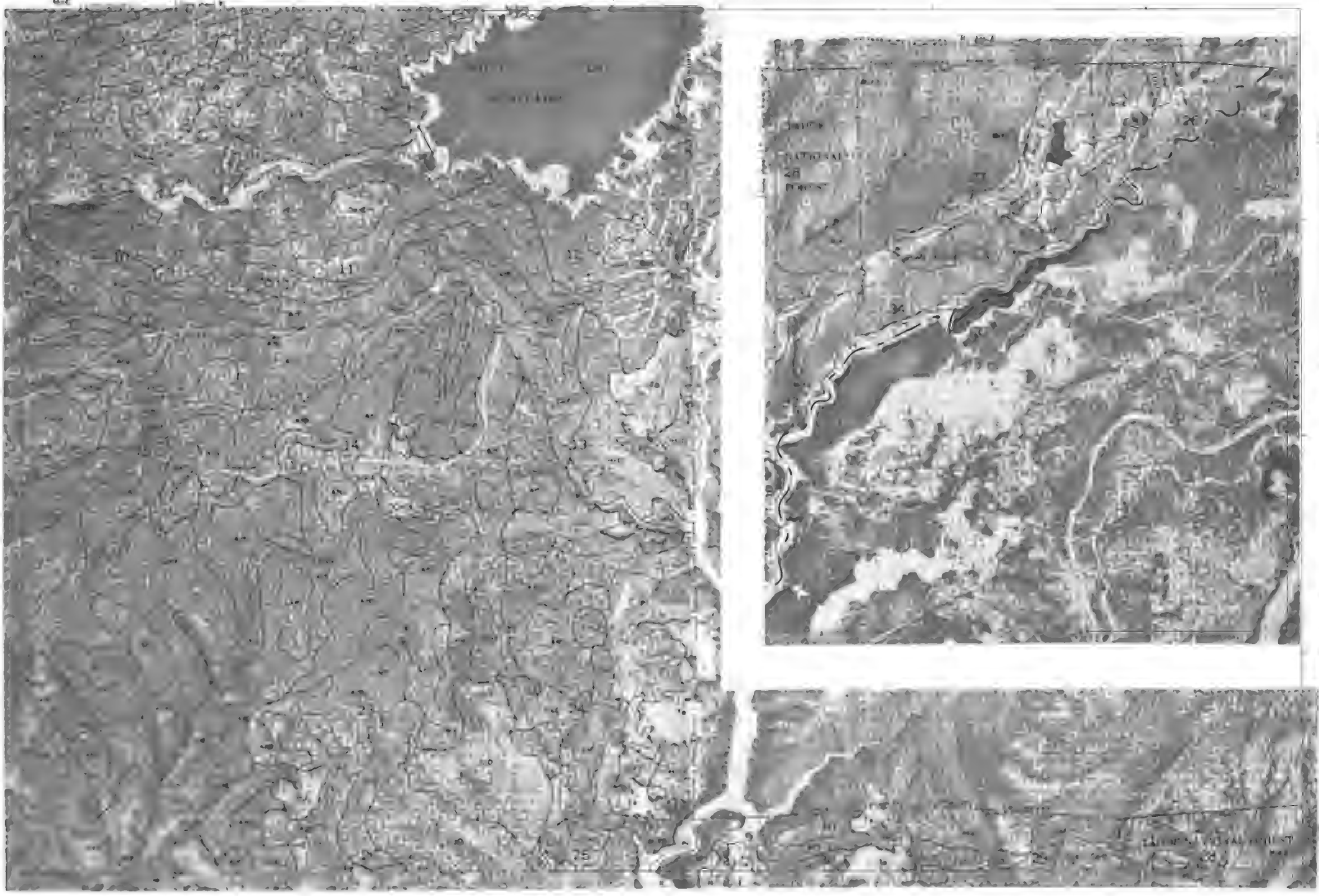
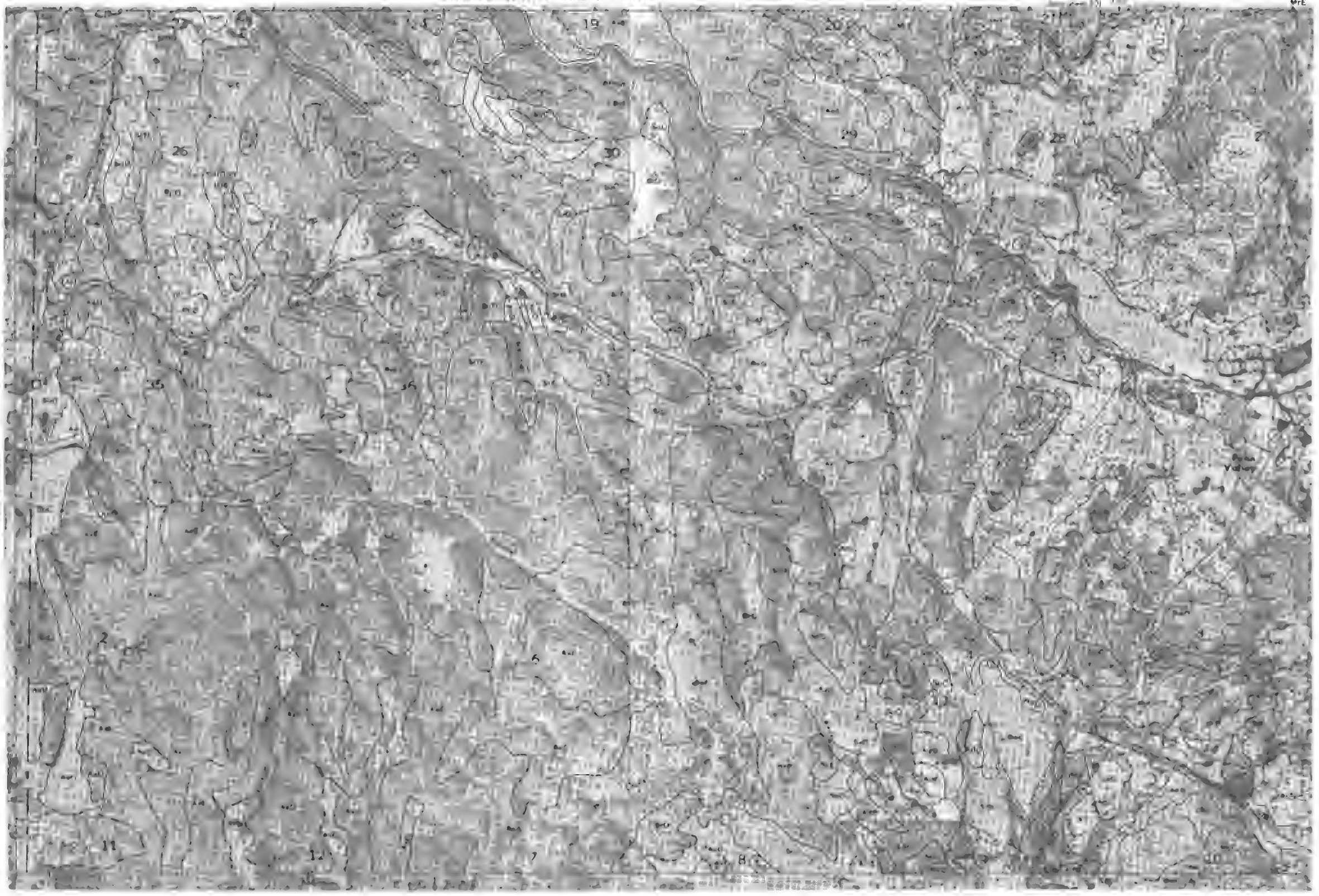
Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum.
Land division corners are approximately positioned on this map.



NEVADA COUNTY AREA, CALIFORNIA NO 13

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 14



14

N

2 Miles 1 0

1" 000 feet 0

Scale 1:24 000

5,000 4,000 1,000 0

Land division corners are approximately positioned on this map

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2. 1927 North American datum

NEVADA COUNTY AREA, CALIFORNIA NO. 14

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 15

NEVADA COUNTY AREA, CALIFORNIA NO. 15

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Photobase from 1972 aerial photography. Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum
Land division corners are approximate positions on this map

15

N

Scale 1:24 000

2 Miles

10 000 Feet

GRASS VALLEY

Osceola Ravine

Swamp Creek

Rex Reservoir

Grub Creek

Clear Creek

Am Creek

French Ravine

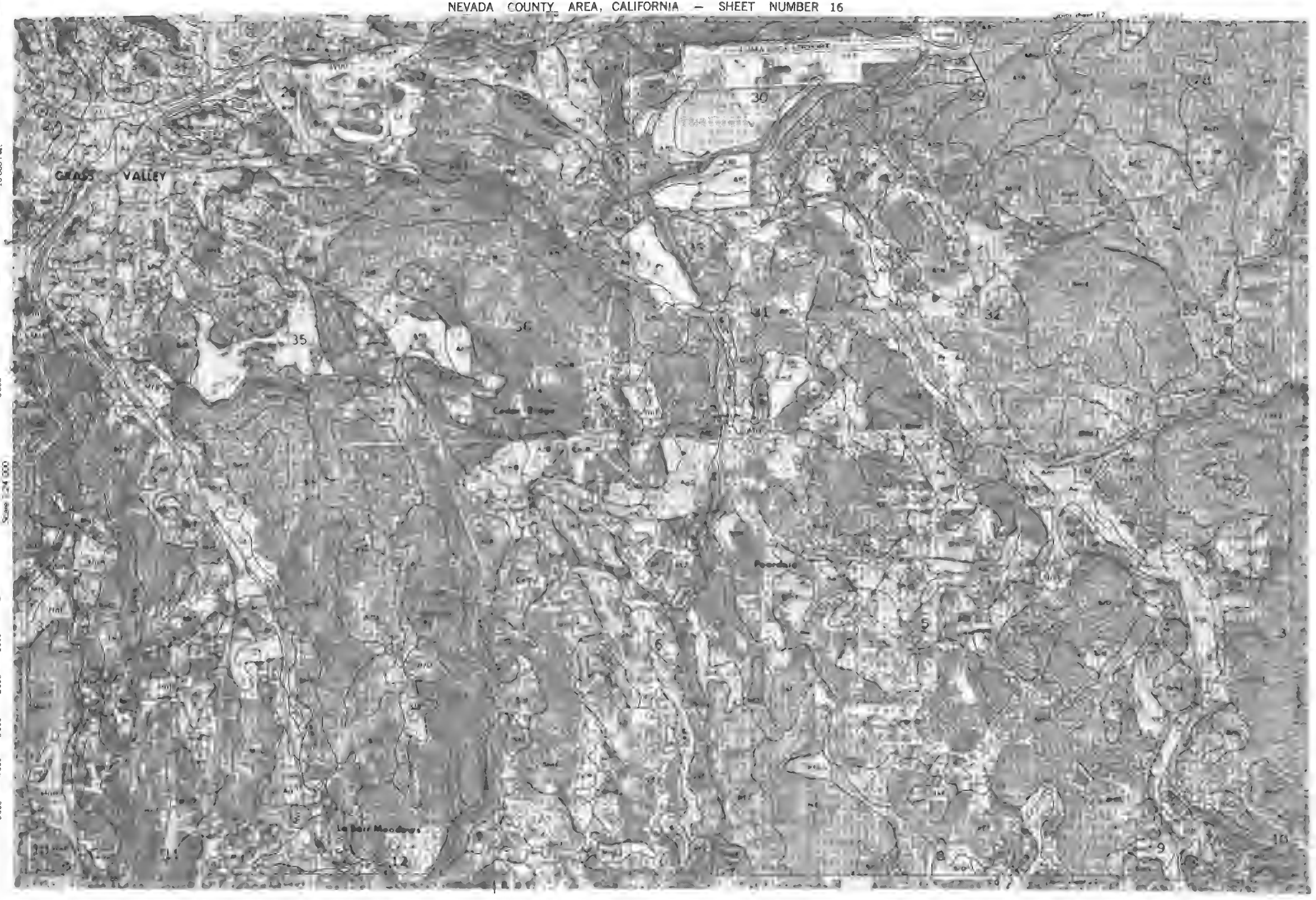
Joins sheet 14

Joins sheet 16

Joins sheet 19

2 260 000 FEET

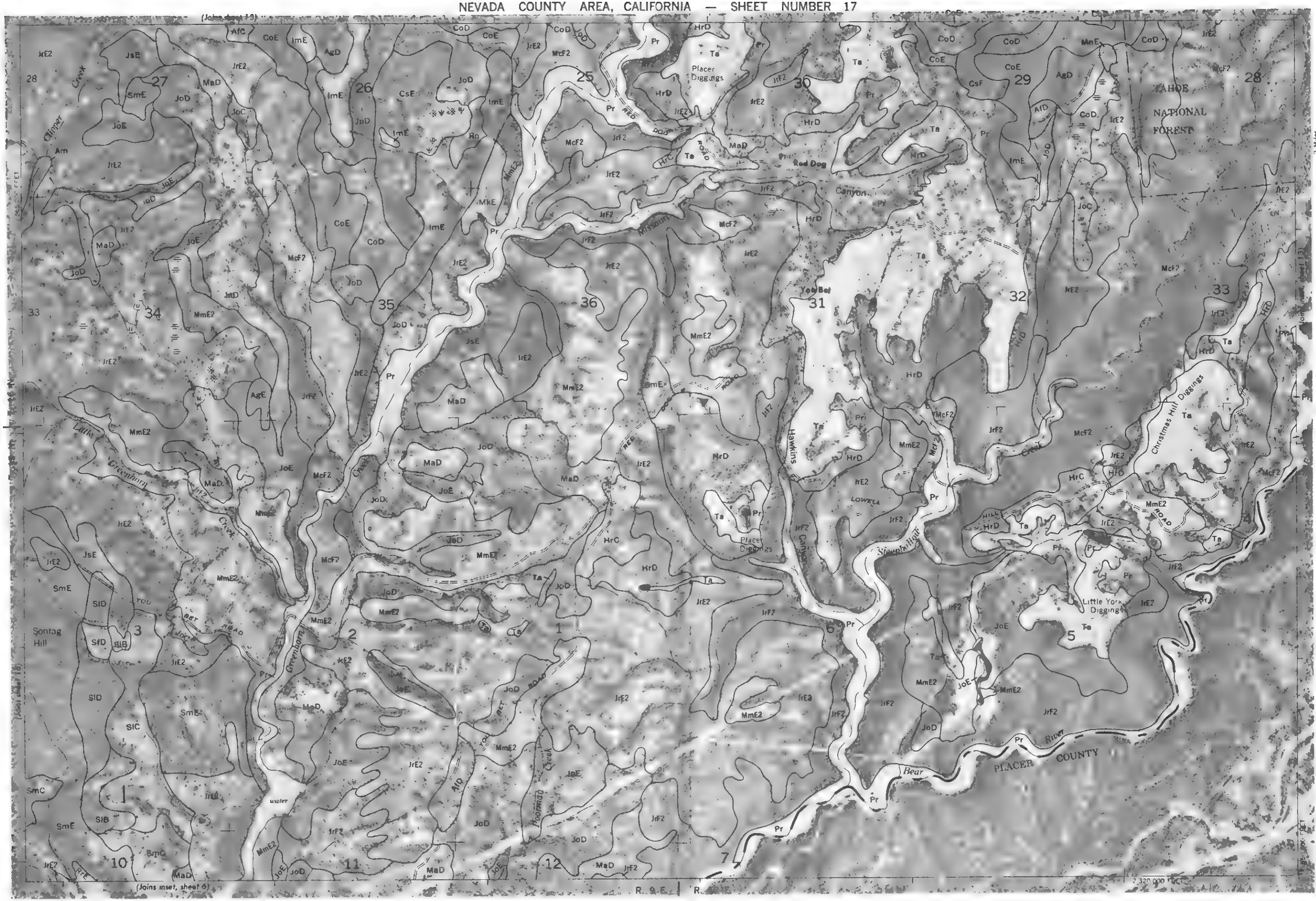
2 235 000 FEET



Land division corners are approximately positioned on this map

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U S Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum

NEVADA COUNTY AREA, CALIFORNIA NO. 16



NEVADA COUNTY AREA, CALIFORNIA NO 17

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum
Land division corners are approximately positioned on this map

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 18

NEVADA COUNTY AREA, CALIFORNIA NO. 18

NEVADA COUNTY AREA, CALIFORNIA NO 19

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum.
Land division corners are approximately positioned on this map

2 235 000 FEET

(Joins sheet 18)

(Joins sheet 15)

(Joins sheet 20)

(Joins sheet 22)

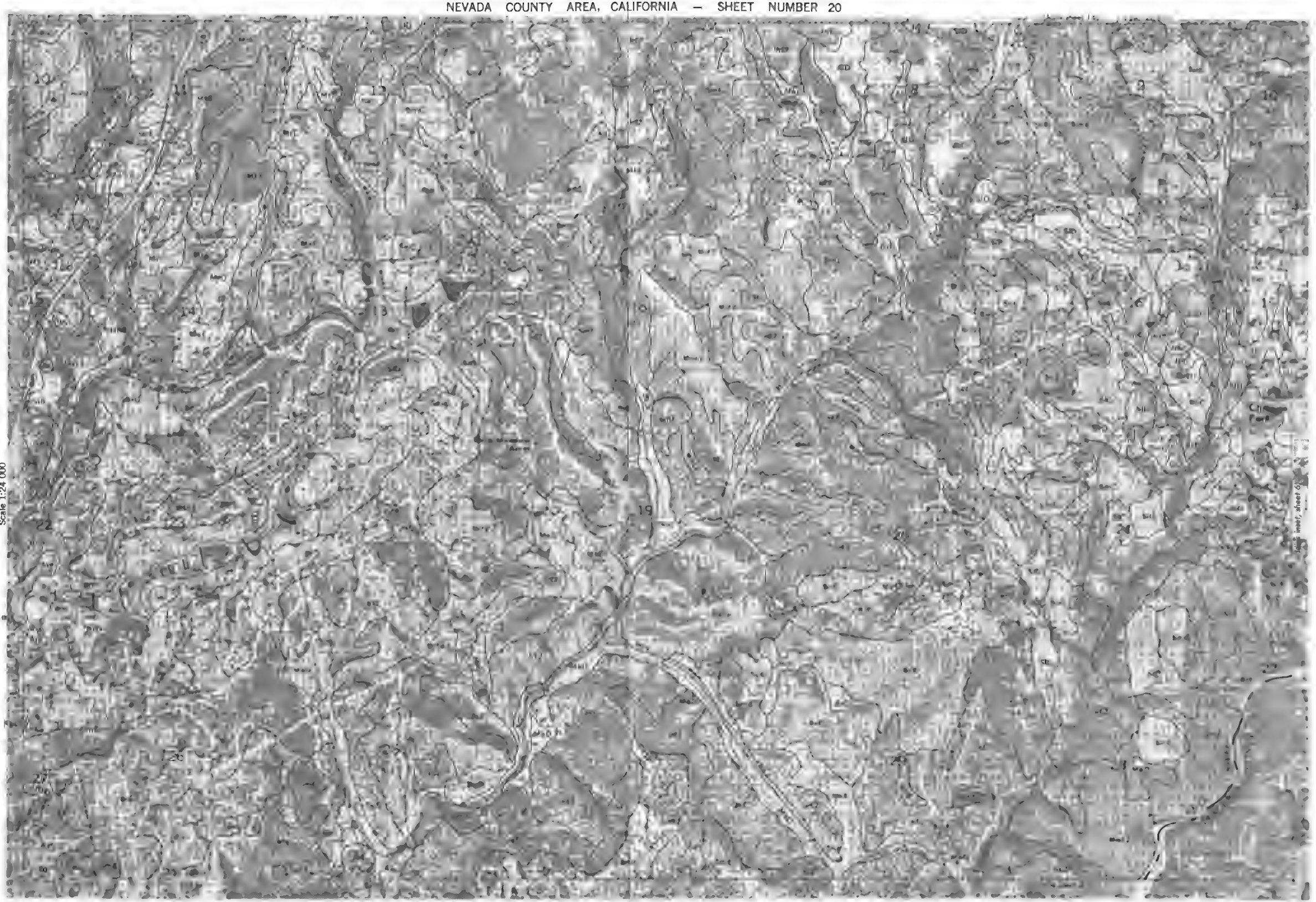
2 260 000 FEET

N

2 Miles 10 000 Feet

Scale 1:24 000

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 20



Scale 1:24 000

2000 1000 0 2000 4000 6000 8000 10 000 Feet

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station
Photobase from 1972 aerial photography Positions of 5,000 foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum
Land division corners are approximately positioned on this map

NEVADA COUNTY AREA, CALIFORNIA NO. 20

NEVADA COUNTY AREA, CALIFORNIA — SHEET NUMBER 21

(Joins sheet 18)

2 235 000 FEET

R. 6 E. | R. 7 E.

T. 15 N.

T. 14 N.

Dry Creek

Iron Mountain

Bushy Mountain

Camp Far West Reservoir

Rock Creek

Austin Ravine

Rab Ravine

McCOURTNEY ROAD

PERIMETER ROAD

Little Dry Creek

(Joins sheet 24)

2 230 000 FEET

21

N

2 Miles

10 000 Feet

Scale 1:24 000

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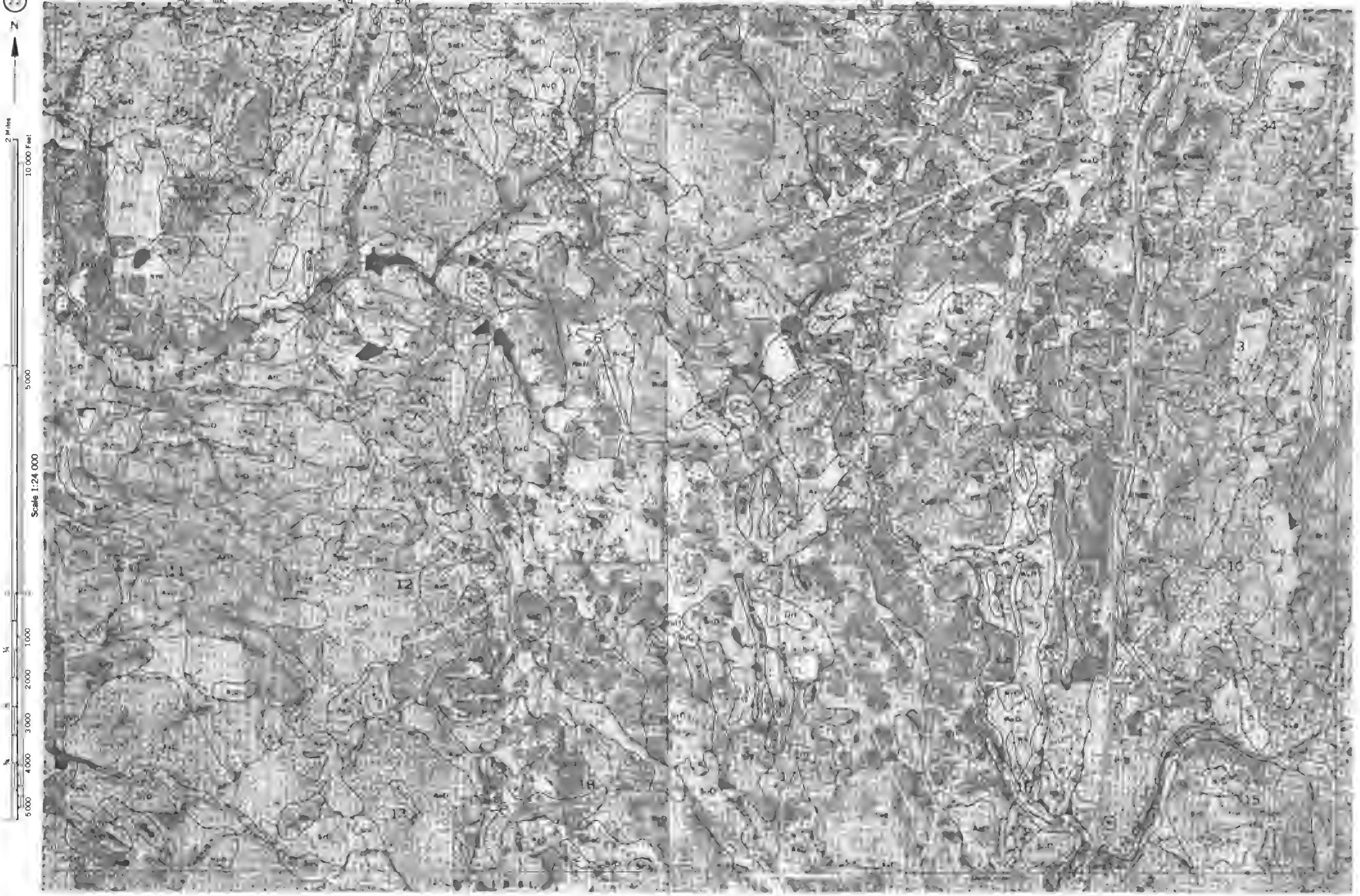
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2 1927 North American datum.
Land division corners are approximately positioned on this map.

NEVADA COUNTY AREA, CALIFORNIA NO. 21



Land division corners are approximately p[illegible]ed on this map

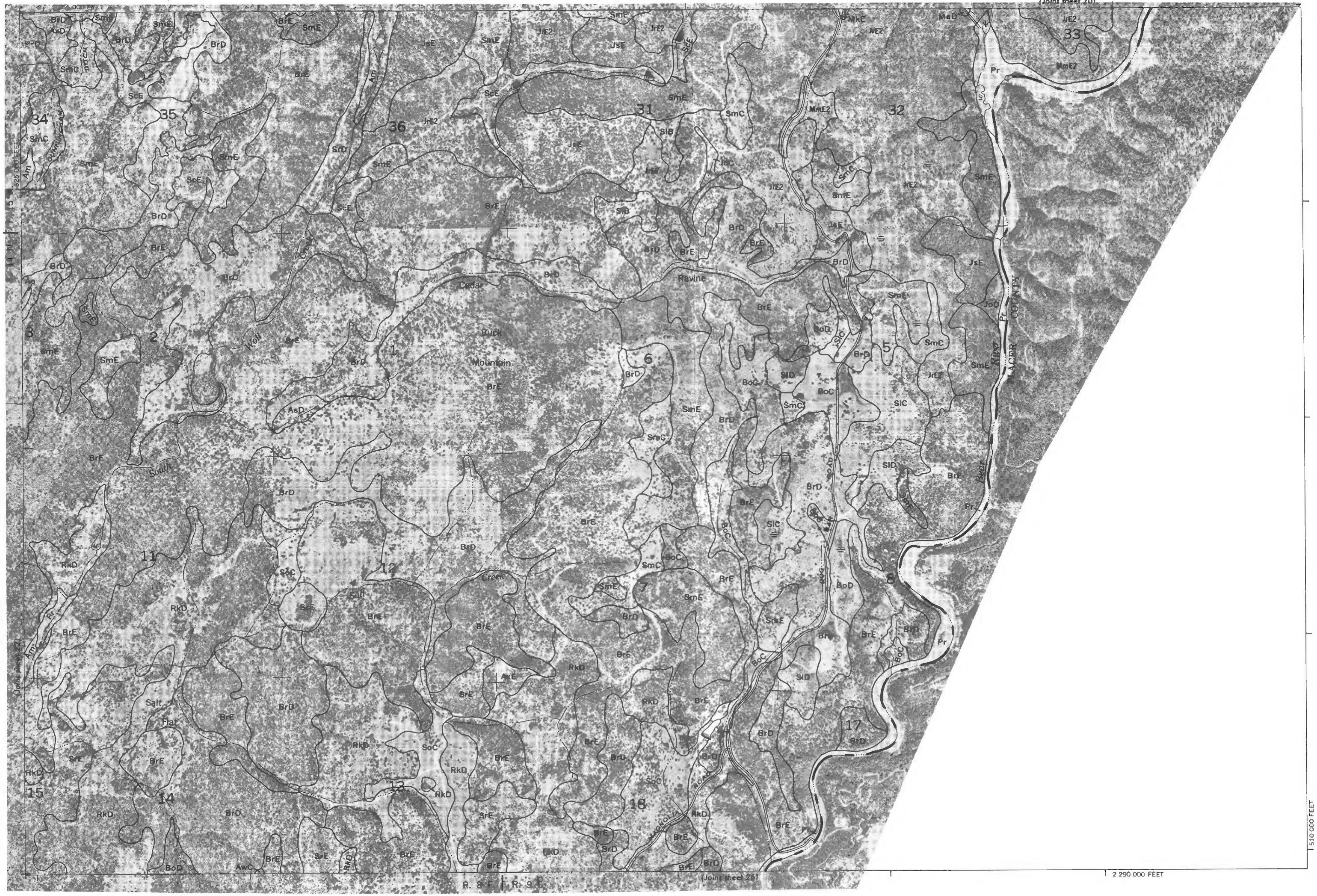
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coord[illegible]ate system, zone 2, 1927 North American datum

NEVADA COUNTY AREA, CALIFORNIA NO. 22

23

N



2 Miles

10 000 Feet

Scale 1:24 000

NEVADA COUNTY AREA, CALIFORNIA NO. 23

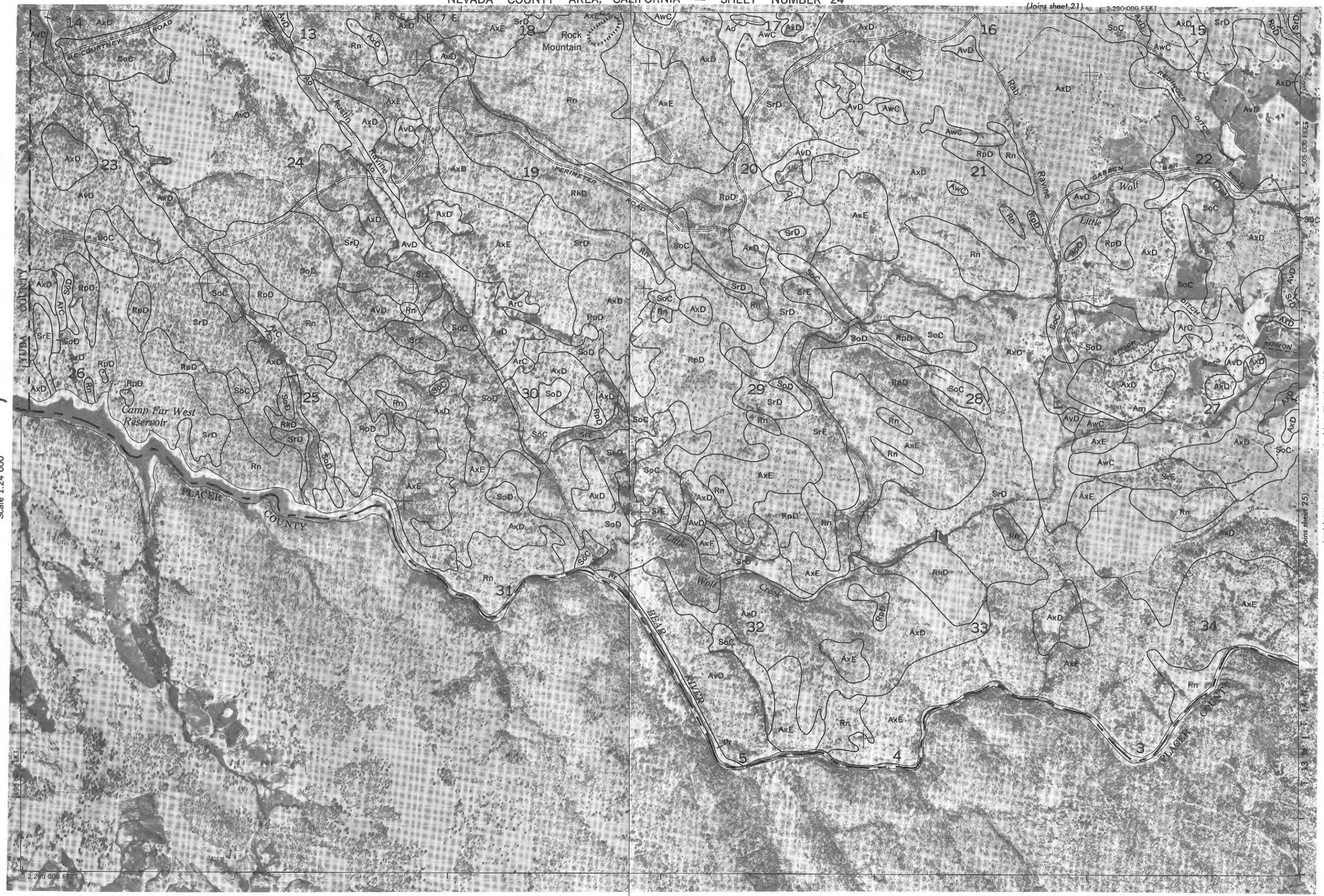
This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2. 1927 North American datum.

Land division corners are approximately positioned on this map.

(Joins sheet 21)

(Joins sheet 25)



Scale 1:24 000

2 Miles 10 000 Feet

1 5000 0 1000 2000 3000 4000 5000 FEET

Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2. 1927 North American datum.

NEVADA COUNTY AREA, CALIFORNIA NO. 24

NEVADA COUNTY AREA, CALIFORNIA NO. 25

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.
Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2, 1927 North American datum.
Land division corners are approximately positioned on this map.

(Main sheet 22)

(Main sheet 28)

25

N

2 Miles

10 000 Feet

1

5 000

Scale 1:24 000

T. 14 N.

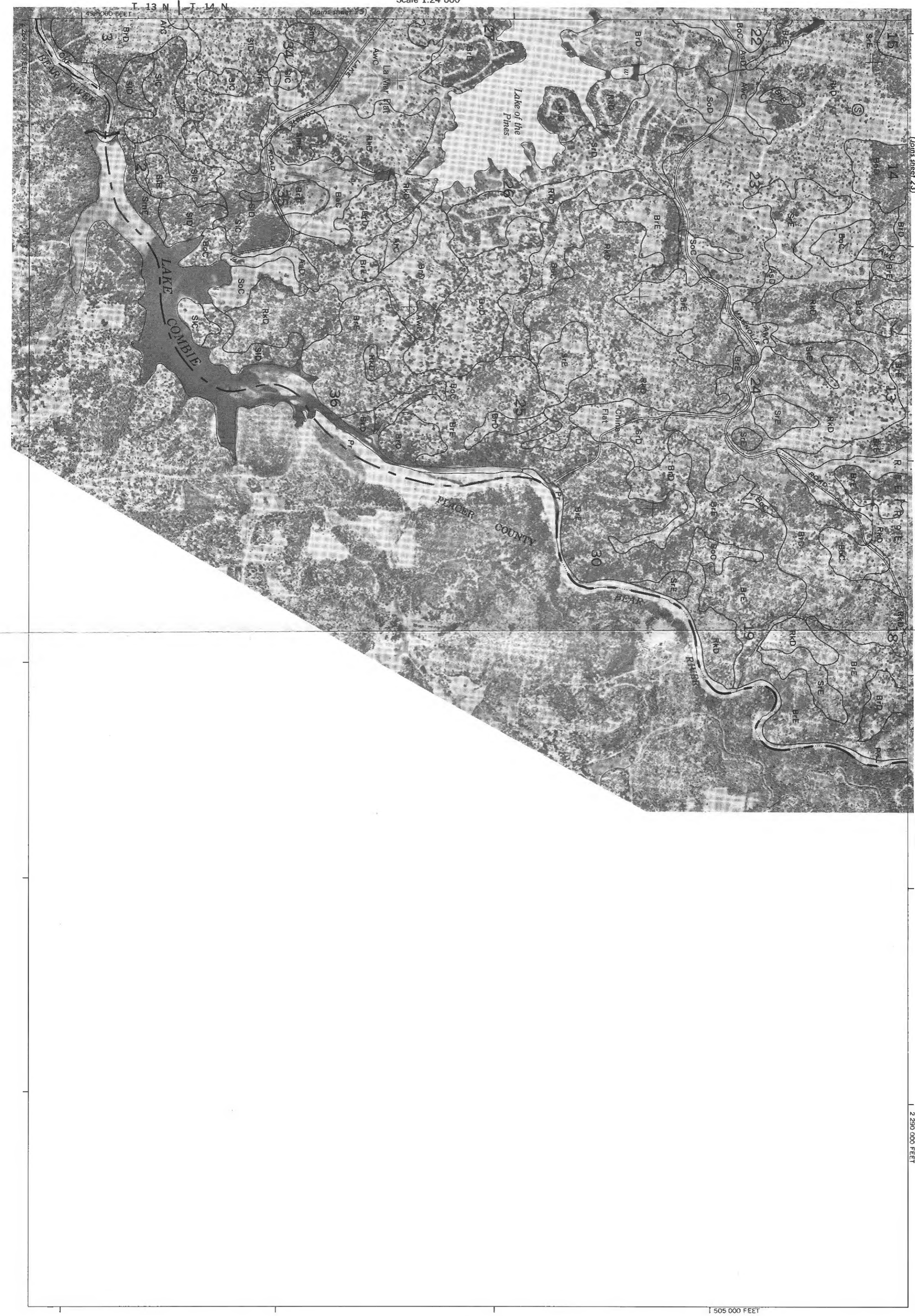
T. 13 N.

R. 7 E. | R. 8 E.

506 000 FEET

490 000 FEET

2250000 FEET



Land division corners are approximately positioned on this map.

This map is one of a set compiled in 1973 as part of a soil survey by the United States Department of Agriculture, Soil Conservation Service, U.S. Forest Service and the University of California Agricultural Experiment Station.

Photobase from 1972 aerial photography. Positions of 5,000-foot grid ticks are approximate and based on the California coordinate system, zone 2. 1927 North American datum.

NEVADA COUNTY AREA, CALIFORNIA NO. 26